U.S. Army Research Institute
for the Behavioral and Social Sciences

Research Report 1727

Structured Training for Units in the Close Combat Tactical Trainer: Design, Development, and Lessons Learned

Michael R. Flynn
Litton-PRC, Inc.

Charlotte H. Campbell
Human Resources Research Organization

William E. Myers
TRW

Billy L. Burnside
U.S. Army Research Institute

September 1998

U.S. Army Research Institute
for the Behavioral and Social Sciences

A Directorate of the U.S. Total Army Personnel Command

EDGAR M. JOHNSON
Director

Research accomplished under contract
for the Department of the Army

Litton-PRC, Inc.

Technical review by

Dorothy L. Finley, ARI
LTC Dan Magee, TSM CATT, Ft. Knox

NOTICES

DISTRIBUTION: Primary distribution of this Research Report has been made by ARI. Please address correspondence concerning distribution of reports to: U.S. Army Research Institute for the Behavioral and Social Sciences, Attn: TAPC-ARI-PO, 5001 Eisenhower Ave., Alexandria, VA 22333-5600.

FINAL DISPOSITION: This Research Report may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The findings in this Research Report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy) September 1998	2. REPORT TYPE Final	3. DATES COVERED (from. . . to) July 1996-July 1998

4. TITLE AND SUBTITLE Structured Training for Units in the Close Combat Tactical Trainer: Design, Development, and Lessons Learned	5a. CONTRACT OR GRANT NUMBER DASW01-94-D-0011
	5b. PROGRAM ELEMENT NUMBER O603007A
6. AUTHOR(S) Flynn, M. R. (Litton-PRC, Inc.); Campbell, C. H. (HumRRO); Myers, W. E. (TRW); Burnside, B. L. (ARI)	5c. PROJECT NUMBER A793
	5d. TASK NUMBER 2124
	5e. WORK UNIT NUMBER R01
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Litton-PRC, Inc. (Prime) 1500 PRC Drive McLean, VA 22102 TRW 6001 Indian School Road Albuquerque, NM 87110 Human Resource Research Organization (HumRRO) 66 Canal Center Plaza, Ste. 400 Alexandria, VA. 22314 U.S. Army Research Institute, Armored Forces Research Unit ATTN: TAPC-ARI-IK, 2423 Morande Street Fort Knox, KY 40121	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences 5001 Eisenhower Avenue Alexandria, VA 22333-5600	10. MONITOR ACRONYM ARI
	11. MONITOR REPORT NUMBER Research Report 1727

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

Billy L. Burnside, Contracting Officer's Representative

14. ABSTRACT *(Maximum 200 words)*:

This report describes the "Structured Training for Units in the Close Combat Tactical Trainer (STRUCCTT)" Project. The purposes of this project were to: (a) design and develop a basic core set of exercises to support initial Close Combat Tactical Trainer (CCTT) user testing and future fielding, and (b) develop an exercise framework within which future exercises can fit as part of a contextually complete family of exercises. This report first describes the background of this initiative (the use of structured simulation-based training in CCTT) and identifies the objectives laid out for project completion. It then discusses the project's design, development, and formative evaluation processes. The design section describes the processes and procedures involved in creation of the exercise mission scenarios and training objectives. The development section highlights the processes that comprise and contribute to the creation of completed exercises, to include training support packages and demonstrations of performance. The formative evaluation section describes the project evaluation strategy and methodology, and the processes by which exercise testing and modification were conducted. Following this section, the lessons learned section presents issues which framed the project's progress and development, and which may provide insight and directions for additional developmental work. A final concluding section discusses the ramifications of this project, with recommendations for future development efforts.

15. SUBJECT TERMS

Structured Training; Close Combat Tactical Trainer; Cavalry Training; Training Methods; Simulation-Based Training; Armor Training; Task Force Training

SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON (Name and Telephone Number)
16. REPORT	17. ABSTRACT	18. THIS PAGE			
Unclassified	Unclassified	Unclassified	Unlimited	84	Billy L. Burnside (502) 624-3450

FOREWORD

The use of simulations in U.S. Army training continues to increase, as does the need for tools and techniques for exploiting simulation capabilities. The U.S. Army Research Institute has for the past several years been a leader in the development of structured training approaches providing such tools and techniques, primarily through work accomplished in the Armored Forces Research Unit (AFRU) at Fort Knox, Kentucky. A key portion of this work has been the development of structured training for virtual simulations, focused on execution at battalion-and-below levels. This work began with the development of innovative training methods using Simulation Networking (SIMNET) in the Virtual Training Program, and has continued with the extension of these methods to the Army's latest virtual simulation, the Close Combat Tactical Trainer (CCTT).

This report describes the initial development and formative evaluation of structured training exercises and support packages for the CCTT. This effort was entitled "Structured Training for Units in the CCTT (STRUCCTT)." The AFRU accomplished this effort as part of Work Package 2124, "Strategies for Training and Assessing Armor Commanders' Performance with Devices and Simulations (STRONGARM)." The relevant requirements document is a Memorandum for Record between the AFRU and the Project Manager for the Combined Arms Tactical Trainer (PM CATT), entitled "Structured Training for the Close Combat Tactical Trainer," dated 25 July 1997.

The training exercises and support packages developed under STRUCCTT have been delivered to CCTT sites at Fort Hood, Texas, Fort Benning, Georgia, and Fort Knox, Kentucky, as well as to the PM CATT and the Training and Doctrine Command System Manager for CATT. These products support CCTT fielding, and units and site personnel are using them to implement training in the CCTT. In addition, the STRUCCTT products provided critical support for the CCTT Limited User Test in early 1997 and the CCTT Initial Operational Test and Evaluation during early 1998. This report documents the methods and lessons learned in developing and formatively evaluating these products. It will be useful to individuals and agencies involved in the development, implementation, and expansion of structured simulation-based training, now and in the future.

ZITA M. SIMUTIS
Technical Director

ACKNOWLEDGEMENTS

This report represents the efforts of an integrated team of military analysts, training developers, and simulation technology experts. The authors were supported by a highly skilled and dedicated group of professionals. A team of military subject matter experts/training analysts, performing the majority of the detailed tactical and simulation work, under the leadership of Mr. William Holden (HumRRO), included Mr. William Koehler (Litton-PRC), Mr. Don Forrest and Mr. Jim Nepute (HumRRO), Mr. Dave Allen and Mr. Rick Bennett (BDM[1]). Training development expertise was provided by Ms. Rebecca P. Mauzy (Hughes Training, Inc.[2]) and Ms. Alicia Sawyer (BDM[1]), whose assistance on the train-the-trainer materials proved invaluable. Technical support was expertly provided by Mr. M. A. "Bud" Dannemiller (Litton-PRC) (who also contributed significantly to overall project coordination), Mr. Mike Bonnett (HumRRO), and Mr. Wesley P. Wilson (BDM[1]). Mr. Richard Deatz (HumRRO) and Mr. D. Bradley Britt (BDM[1]) worked together to create performance demonstrations, an outstanding tactical-training development effort which resulted in the multimedia products to support training. Mrs. Peggy Salmon (Litton-PRC) was the team's administrative wizard, keeping the day-to-day operations on track. Graphic art support, including tactical graphics, briefing materials, and multimedia support, was expertly accomplished by Ms. Kari Knight (Litton-PRC). Thanks also go to members of related simulation projects who assisted during critical periods of the project.

An important contributor to the project was LTC Dan Magee (Close Combat Tactical Trainer [CCTT] Project Officer); his assistance in getting troop support and his frequent input, especially on tactical issues, was instrumental in the timely completion of this project. Assisting the Contacting Officer's Representative (COR) in overseeing project direction and guiding the team's efforts was Dr. David W. Bessemer (U.S. Army Research Institute).

Implementation of the project would have been impossible without the cooperation of a number of other individuals. Members of the Fort Hood and Fort Knox CCTT Pulau Site staff (Mr. Bert Chole, Mr. Kirt Highberger, Mr. Dave Merrill, and Mr. Greg Story, to name a few) provided system access and support, as well as outstanding feedback on our training materials and process. The U.S. Army Simulation, Training and Instrumentation Command (STRICOM) granted us access to the CCTT system throughout the life of the project, with special thanks to Mr. John Foster (STRICOM), Mr. Oscar Ramos and Mr. Dave Johnson (Science Applications International Corporation), and Mr. Randy Howell (Lockheed-Martin) for their support and expertise. Cooperation from Mrs. Ruth Ford (Nations) ensured our efforts matched her computer-based instruction (CBI) prerequisite training on the CCTT system. The U.S. Army Test and Experimentation Command (TEXCOM) (Mr. Floyd Smith) graciously provided the opportunity to observe exercise execution and collect data during the Limited Users Test (LUT).

Finally, special thanks go out to the members of the 1st Cavalry Division, Fort Hood, TX, who participated in the LUT and other related CCTT training exercises. Their participation was greatly appreciated, and provided us the opportunity to improve the CCTT exercises.

[1] Now TRW, Inc.
[2] Now Raytheon.

STRUCTURED TRAINING FOR UNITS IN THE CLOSE COMBAT TACTICAL TRAINER: DESIGN, DEVELOPMENT, AND LESSONS LEARNED

EXECUTIVE SUMMARY

Requirement:

The Structured Training for Units in the Close Combat Tactical Trainer (STRUCCTT) Project was initiated in order to produce a structured training program that would incorporate associated tools, ensure effective and efficient use of the simulation, and support the fielding of the Close Combat Tactical Trainer (CCTT). A key near-term requirement was to provide structured training exercises and associated Training Support Packages (TSP) to support the CCTT Initial Operational Test and Evaluation (IOT&E).

The project included design, development, and formative evaluation of the CCTT structured training program components. Specific objectives were to: design and develop structured training exercises and TSPs required to support CCTT IOT&E; formatively evaluate and revise the exercises and TSPs based on monitoring their implementation during the IOT&E; and document lessons learned that relate to future development of structured training for the CCTT.

Procedure:

This project required design of a library of training exercises at the platoon, company team, and battalion task force (TF) levels in the CCTT. The project applied the structured simulation-based training development methodology (Campbell, Campbell, Sanders, Flynn, & Myers, 1995) created during the "Simulation-Based Multiechelon Training Program for Armor Units (SIMUTA)" Project and modified as part of the "Combined Arms Operations at Brigade Level, Realistically Achieved Through Simulation (COBRAS)" Project (Campbell, Deter, & Quinkert, 1997). The design process culminated in the creation of basic outlines of all the exercises.

Program design was followed by development of a selected number of exercises, within three missions (movement to contact, defense in sector, and deliberate attack), together with a set of fundamental exercises, conducted on simulated National Training Center (NTC) terrain. This included multimedia "demonstrations of performance" which provided examples of successful exercise execution. The exercise set represents an initial example of those core exercises needed to provide units a structured simulation-based training experience. They have been placed within a TSP framework that allows them to be incorporated into a coherent unit training strategy. A significant portion of the development phase was the creation (often referred to as "building") of the CCTT electronic exercise files. The exercises were tested internally, and revised in preparation for use during user testing.

The formative evaluation of the structured exercises was conducted in conjunction with a Limited User Test (LUT) of CCTT when the government decided to postpone the IOT&E. The

evaluation included developmental testing conducted with members of operational units, during which developers were able to make corrections and probe users for their reactions and suggestions. The LUT then provided the opportunity to observe an actual trial implementation of the exercises, although observation of unit pre-exercise preparation, a key component of the TSP, was not possible. Throughout this process, units performed numerous exercise runs to verify the tactical exercise play, test the performance observation and feedback system, and evaluate the training management structure. The identification of lessons learned from the implementation provided direction for system improvement and has already facilitated the next iteration of structured training exercise development for CCTT.

The development effort resulted in two TSPs: one for training at the platoon and company team-level, and one for training at the battalion TF-level. The developed exercises included fundamentals (basic tactics and combat skills) as well as all three missions. Additionally, environmental conditions (day, night, and fog) as well as enemy capabilities (e.g., type, strength, and competency) were included within the exercises in order to vary exercise difficulty and provide for a crawl-walk-run training progression. Multimedia demonstrations of performance were created for selected exercises to provide examples of successful task and exercise performance. The set of 40 exercises represents an initial core group of exercises within structured and logical mission training sets, and provides the basis for additional exercise development work.

Findings:

At the conclusion of this project, the project objectives had been largely achieved. In the development arena, the team had applied the structured training methodology and process to the CCTT. The STRUCCTT exercises were used to provide the vehicle for total CCTT training system evaluation. The success of the LUT demonstrated the efficacy of these exercises and the training development methodology within which they were created. Working with CCTT during its development allowed the project team to provide some information on how the system can best be used for training. One of the more significant products is the collection of lessons learned, discussed in this report. Many of these lessons were implemented during the project, while others are presented for future efforts.

Utilization of Findings:

The intended audience for this report includes: (a) simulation system developers (hardware and software) and integrators, (b) training program designers and developers, (c) training implementers (CCTT sites and units) who must maintain the program and recommend improvements to it, and (d) any member of the U.S. Army who desires to better understand the process by which programs of this kind are created and implemented.

STRUCTURED TRAINING FOR UNITS IN THE CLOSE COMBAT TACTICAL TRAINER: DESIGN, DEVELOPMENT, AND LESSONS LEARNED

CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

STRUCTURED TRAINING FOR UNITS IN THE CLOSE COMBAT TACTICAL TRAINER: DESIGN, DEVELOPMENT, AND LESSONS LEARNED

Introduction

The evolution of simulation and training device technology in the U.S. Army is continuing. By 1995, the virtual reality training environment first demonstrated in Simulation Networking (SIMNET) in the 1980's had matured and was being developed further by the U.S. Army Simulation, Training and Instrumentation Command (STRICOM) through the Combined Arms Tactical Trainer (CATT) Program. The CATT was to be a family of training systems designed to support the training of armor, mechanized infantry (mounted and dismounted), aviation, air defense, engineer, and field artillery units and personnel at the crew through battalion task force (TF) level. This family of systems would use networked simulation technology to provide a cost-effective means of conducting a variety of combined arms and joint operations training, while reducing the impact and restrictions of weapons effects safety, terrain limitations, personnel turbulence, resource scarcity, and time. The Close Combat Tactical Trainer (CCTT) was the first system developed and tested under the CATT Program to meet the Army's established training requirements.

A key concern in the development of new training simulations and devices is how they are incorporated into Army training doctrine (U.S. Department of the Army [DA], 1988a). This is especially true today, where resources such as maneuver space, repair parts, operational logistics, and time are at a premium. One example of the effective use of simulation is the Virtual Training Program (VTP) at Fort Knox. Since 1994, the VTP has utilized simulation technology (primarily SIMNET) to deliver task-focused training to combat maneuver forces through a learning methodology known as structured simulation-based training (Burnside, Leppert, & Myers, 1996).

Structured simulation-based training is instruction that is deliberately designed, developed, and implemented to take advantage of the capabilities of the simulation and to enable the accomplishment of specific training objectives in a planned sequence. It ensures training on mission-specific Army Training and Evaluation Program Mission Training Plan (ARTEP-MTP) tasks because events and cues are orchestrated to trigger the execution of specific tasks. This structured simulation-based training includes an after action review (AAR) that allows observer/controllers (O/Cs) to provide feedback focused on the actions of the training audience. Typically, structured training provides multiple opportunities for units to perform groups of tasks at different levels of difficulty, requiring increasing levels of expertise. Structured training is implemented through a complete training support package (TSP) that includes all the materials necessary to organize and conduct training and provide training feedback.

The project described in this report, entitled "Structured Training for Units in the Close Combat Tactical Trainer (STRUCCTT)," extended the structured simulation-based training approach developed in previous Army Research Institute (ARI) projects to the emerging technology of CCTT. The exercises developed as part of the STRUCCTT Project help to bridge the gap between crew training and collective field training at the platoon, company team, and

battalion task force (TF) levels. The nature of structured training facilitates implementation of the incremental crawl-walk-run training philosophy inherent in a progressive unit training program.

Purpose of the Report

The purpose of this report is to describe the STRUCCTT Project and to detail the lessons learned in designing, developing and evaluating the STRUCCTT training products and in using those products during the initial user test. The background of the project outlines the major events and significant decisions made. Lessons learned were drawn from team members and other individuals associated with the CCTT system throughout the project. By studying this report, the reader should gain a thorough understanding of the goals of the project, the project's development and evolution, and the challenges that exist when working with developing or newly fielded systems.

Organization of the Report

This report documents the design and development of the exercises; design and development of the TSPs, train-the-trainer materials, and demonstrations of performance; the evaluation of the exercises during initial user testing and the subsequent revision of the TSPs; and the lessons learned throughout this process. Specifically, the following sections contain:

- An overview of the project, covering the project objectives, major events and decisions.
- A discussion of the design of the program, development of the scenarios, and design and development of exercises and TSPs. The discussion includes operations order (OPORD) development and review, exercise outlining, design and development of train-the-trainer materials, design and creation of the demonstrations of performance, and the functioning of all products within the CCTT system.
- Formative evaluation processes and results.
- Lessons learned relevant to future training development efforts.
- A review of the project's outcomes and future directions.

Overview of the STRUCCTT Project

The objectives of the project were established by ARI and the Training and Doctrine Command (TRADOC) System Manager for the Combined Arms Tactical Trainer (TSM-CATT). Both these agencies provided guidance and support to the project team early in the project that helped form the basis for the overall project execution. This section describes the background, purpose and objectives of the project, the project time line, and a brief summary of the project's major decisions and events.

Background

The Army recognized a need for a standardized set of training exercises for CCTT to allow the Initial Operational Test and Evaluation (IOT&E) to fully assess CCTT capabilities. An IOT&E is an assessment of new equipment to determine whether the equipment performs to the standards for which it was designed. It is the final official Army evaluation of new equipment prior to making a decision on whether or not a system will enter full production. In order for the CCTT to be evaluated as a complete training system, it had to have a set of exercises available to supply realistic and meaningful training to the test units during the IOT&E. Once IOT&E was completed, the exercises would be an integral part of the fielding package for CCTT.

Because of the success in the implementation of structured simulation-based training using SIMNET in the VTP (Shlechter, Bessemer, Nesselroade, & Anthony, 1995), and because of the functional similarities between CCTT and SIMNET, the Army initiated the requirement for a corresponding structured training program for implementation with the CCTT. STRUCCTT was to model itself based on two previous VTP projects, "Simulation-Based Multiechelon Training Program for Armor Units" (SIMUTA) (Hoffman, Graves, Koger, Flynn, & Sever, 1995) and "SIMUTA-Battalion Exercise Expansion" (SIMUTA-B) (Graves & Myers, 1996) exercises. Both these projects focused on virtual training for Armor units and established TSP structures that support such training.

Project Purpose

The overall purpose of the STRUCCTT Project was to design and develop a core set of exercises to support initial CCTT user testing and fielding as part of a structured training program for the CCTT. In addition, the project was to design an exercise framework within which the core set of exercises and future exercises would fit as part of a contextually complete family of exercises. Inherent in both of these was the requirement to evaluate the exercises during their initial use.

The STRUCCTT Project's objectives were succinctly expressed in the original Statement of Work (SOW) (ARI, 1996) as listed below:

1. To design and develop (based on the VTP) complete structured training exercises and TSPs, including training of trainers and demonstrations of performance, required to support the CCTT IOT&E.

2. To formatively evaluate and revise the training exercises and TSPs based on monitoring their implementation during the CCTT IOT&E.

3. To document lessons learned that relate to future development of structured training for the CCTT and other simulations.

The SOW also provided detailed specifications for the project products and outcomes:

- Design and development of 40 exercise tables,[3] based on the tables developed under SIMUTA and SIMUTA-B.
- Modifications to address CCTT operational capabilities, such as dismounted elements, manned modules for fire support and first sergeant, and environmental conditions (fog, night).
- Segmenting company team and platoon operations to provide for a progression of difficulty (crawl, walk, run) within the context of the battalion TF mission scenarios (movement to contact [MTC], defend in sector [DIS], and deliberate attack [DATK]) on the National Training Center (NTC) terrain database.
- Design of a complete program to train the trainers for the IOT&E and for future CCTT training with the IOT&E exercises.
- Inclusion of demonstrations of performance for the training audience to show them a way to perform the tasks in each table.
- Internal quality assurance exercises, or pilot testing, for all training tables, with the IOT&E serving as the trial, or final user test, of the tables and TSPs developed.

Project Time Line

The STRUCCTT Project was formally initiated on 1 August 1996. The project team consisted of 14 members, six of whom had experience on related VTP projects. The team included military subject matter experts, simulation system experts, training developers, administrative support and a multimedia specialist.

The project time line (Figure 1) shows the major milestones identified in the SOW and Execution Plan (STRUCCTT Team, 1996). The project began late in the CCTT system development cycle. When the project began, the system was in the midst of integration testing on a very tight and full schedule. Access to a complete system was limited and possible only at the Lockheed-Martin Test Facility (LMTEF) in Orlando, FL. The STRUCCTT Team requirements had not been included in the existing schedule, which made the project time line a "best guess" on what could be accomplished.

As the project progressed, the STRUCCTT effort became integrated into the system developers' planning. This is one of the big successes of the project and is discussed in the lessons learned section.

---

[3] A "table" is defined as a short, focused exercise segment, usually lasting one to two hours, followed by an after action review (AAR).

	1996				1997						
Deliverables	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**
Execution Plan	◆										
Design Plan		◆									
Initial Company Team and Platoon TSPs				◆							
Company Team and Platoon Demos					◆						
Battalion TF TSP						◆					
Exercise Evaluation							◆	········	◆		
Post IOT&E IPR									◆		
Refined TSPs											◆
Final IPR											◆

Figure 1. Initial project time line, developed at the project start.

Project Summary

The first tasks were to review the previously developed structured simulation-based training products and concurrently study all existing explanatory information on CCTT. This aided the team in developing the project execution plan. The execution plan was completed and delivered in early September, and briefed to government personnel during the first in-progress review (IPR) in early October. The plan was approved with no major modifications.

Following the execution plan IPR, the team began exercise design. This included the identification of training tasks, development of exercise tactical scenarios (modification of those borrowed from SIMUTA/SIMUTA-B), and the development of exercise outlines. The information identified during the design effort was to form the basis of the electronic exercise files in the CCTT system and TSPs.

One of the major initial efforts was to understand the hardware and software configuration and functionality of the CCTT in order to identify the procedures required to convert scenario elements into their electronic analogs. Some components of the CCTT system were on-site at Fort Knox, enabling the training developers to get some early hands-on experience. A more complete understanding came during visits to the LMTEF in Orlando, FL where CCTT development and integration testing were taking place. Although the entire system was not available, team members were able to acquire a better understanding of how the system components were designed to interact.

The team made numerous trips to the LMTEF as they investigated the processes and procedures involved in using the CCTT sub-systems to create electronic exercise files. They also visited the initial CCTT Site at Fort Hood, Texas to discuss access to and use of the facility when it became fully equipped and operational.

The project design IPR conducted in October marked the start of the development portion of the project. At this time the government approved the exercise outlines and the overall TSP architecture. The team was able to begin exercise development on the CCTT systems at the LMTEF and at Fort Knox.

As mentioned earlier, the exercises were developed on a system still undergoing its own development. While this complicated the development of the company team and platoon exercises, it also allowed the project team to become very familiar with the system and to work closely with its developers. These experiences proved to be very valuable throughout the remainder of the project.

Initial proofing of each table was conducted by the STRUCCTT developers, to verify starting locations, routes, and other terrain and system-based specifications. During development, the Program Manager (PM) for the CATT used these initial STRUCCTT exercises to conduct initial integration testing of the CCTT, assisted by active unit soldiers. These tests allowed the PM-CATT to evaluate system stability; they also provided the STRUCCTT developers with an early look at how well the exercises supported the tasks selected for training.

The SOW also specified design and development of multimedia examples of task performance in the CCTT exercises that CCTT users could view on a personal computer. In December, a prototype demonstration of performance was shown to ARI and TSM-CATT, resulting in approval for continued development of the demonstrations of performance. At the same time, the preparations for exercise evaluation during the IOT&E continued. This preparation included development and review of a set of draft instruments for formative evaluation of the company team and platoon tables and their associated TSPs.

Exercise development continued in January at the Fort Hood CCTT Site. As each company team and platoon table was completed, proofed by developers, and when possible, tried out with soldiers on the Fort Hood CCTT system, it was placed in a protected directory under the control of the PM-CATT Project Engineer for use during integration testing at Fort Hood and subsequent use during the IOT&E.

In early February 1997, a second IPR was conducted to brief government personnel on exercise development status and methodology. Shortly after the IPR, Army representatives decided to postpone the IOT&E for at least a year, and to conduct a Limited User's Test (LUT) during the time frame initially identified for the IOT&E. A LUT is similar to an IOT&E, but with a less rigorous set of requirements and a limited scope. A successful LUT would support a decision to proceed with limited production of the system. This decision did not affect the development effort of the STRUCCTT exercises.

Development of remaining company team and platoon tables, and TSPs, continued until the PM's pre-LUT system evaluation 17 - 28 March 1997. The capability of all the components of the CCTT system to function as required and to run the training exercises as they were configured during this system evaluation indicated that the exercises and the system were ready for the LUT. A pilot test of the data collection procedures for the LUT and the formative evaluation of the tables was conducted 7 - 11 April 1997. This provided the opportunity to work out final issues and problems prior to conduct of the LUT. It also served as a dress rehearsal to allow all the STRUCTT Team members participating in the data collection effort a chance to ensure their interactions would result in a smooth, well-organized effort.

While formative evaluation activities were ongoing during the entire project, the concluding portion of the formative evaluation of the tables was conducted concurrently with the LUT, from 20 April through 13 June 1997. The focus of this effort was to observe the conduct of the exercises to determine how well they ran on the CCTT and to assess the utility of the TSP materials in conducting training. Units with four different company team organizations participated in the LUT, conducting platoon and company team level exercises on the CCTT. The evaluation included observations by STRUCCTT personnel and surveys of the participants (to include contractors, unit workstation operators, and unit O/Cs); because of the scheduling of the LUT, formal evaluation of the performance demonstrations was not included. Immediately following the LUT, the data were analyzed to identify requirements for improvement and revision of the tables. The final company team and platoon exercise revisions were completed in July 1997.

Following the LUT, the STRUCCTT developers completed development of a battalion TF exercise (MTC). A trial of this exercise (including preparatory crew, platoon, company team, and battalion TF level training) was conducted 23 - 27 June 1997. In addition, the STRUCCTT developers began the process of making final revisions to all the TSP materials. A final IPR on the project was conducted on 22 August 1997.

Design Considerations

Although the STRUCCTT exercises used the SIMNET-based tables as their point of departure, there were significant differences between the CCTT system and SIMNET. These differences required modifications to the SIMNET exercises and TSP designs in order to achieve effective structured training in the CCTT. Additionally, the SOW called for a number of other design changes. These distinctions and their impact on STRUCCTT training design are discussed in this section.

To fully understand the training environment, a short description of the CCTT system is required. Designed for use by both Active and Reserve forces, CCTT is being fielded in fixed site and mobile sets. Each CCTT fixed site will have a mixture of tank (M1A1 or M1A2) and infantry/cavalry fighting vehicle (M2A2/M3A2) manned modules based on the organization and mission of the units supported by the site. Each CCTT site also has the workstations necessary to emulate opposing forces, friendly combat forces, artillery, and critical combat support and combat service support assets. In addition, the sites include an after action review (AAR) workstation,

used by O/Cs to monitor and control the exercises and review performance. The mobile sets, designed to support platoon training, have either four tank (M1A1 or M1A2) or four infantry/cavalry fighting vehicle (M2A2/M3A3) manned modules in addition to workstations and an AAR workstation. The major components that make up a CCTT site (fixed or mobile) are listed in Table 1.

Table 1

Major CCTT Components

Component	Equipment
Manned Modules	M1A1 or M1A2 Manned Modules M2A2/M3A2 Manned Modules Dismounted Infantry (DI) Manned Modules M981 Fire Support Team Vehicle (FIST-V) M113 Armored Personnel Carrier High Mobility Multipurpose Wheeled Vehicle (HMMWV)
Semi-Automated Forces (SAF) Workstations	Blue Forces (BLUFOR) SAF Opposing Forces (OPFOR) SAF
Control Consoles	Master Control Console (MCC) Maintenance Console (MC) AAR workstations
Unit Support or Operations Center (OC) workstations[a]	Workstations emulating the function of other combat, combat support (CS), and combat service support (CSS) elements: Fire direction center (FDC) Field artillery battalion tactical operations center (FABTOC) Fire support element (FSE) Combat engineer support (CES) Tactical air control party (TACP) Combat trains command post (CTCP) Unit maintenance collection point (UMCP)

Note: Normally, a site will be configured with either M1A1s or M1A2s, but not both.

[a] Mobile sites contain only three workstations; to emulate more than three elements, workstations must be configured and operated to control multiple functions.

The mixture of manned modules determines the type and echelon of combat units that can be trained in a fixed site. The SOW for the STRUCCTT Project required developing exercises that would support combined arms company team, tank platoon, and mechanized infantry platoon training at the Fort Hood CCTT site. This requirement meant that the exercises would support either a tank heavy company team (2 tank platoons, 1 mechanized infantry platoon) or a mechanized infantry heavy company team (2 mechanized infantry platoons, 1 tank platoon) as

well as individual tank or mechanized infantry platoons. The CCTT has the capability of training, given sufficient manned modules, pure tank or mechanized infantry companies, as well as, scout platoons and cavalry troops. In addition, the fixed sites are capable of supporting battalion TF command field exercise (CFX)-like training. (A CFX is a field exercise which includes commanders, leaders, and staff, but limits participation of other unit elements.) During the period of the STRUCCTT project, there were insufficient manned modules at the Fort Hood site to support pure tank or mechanized infantry company training. A schematic of the layout of the Fort Hood fixed CCTT Site is shown at Figure 2.

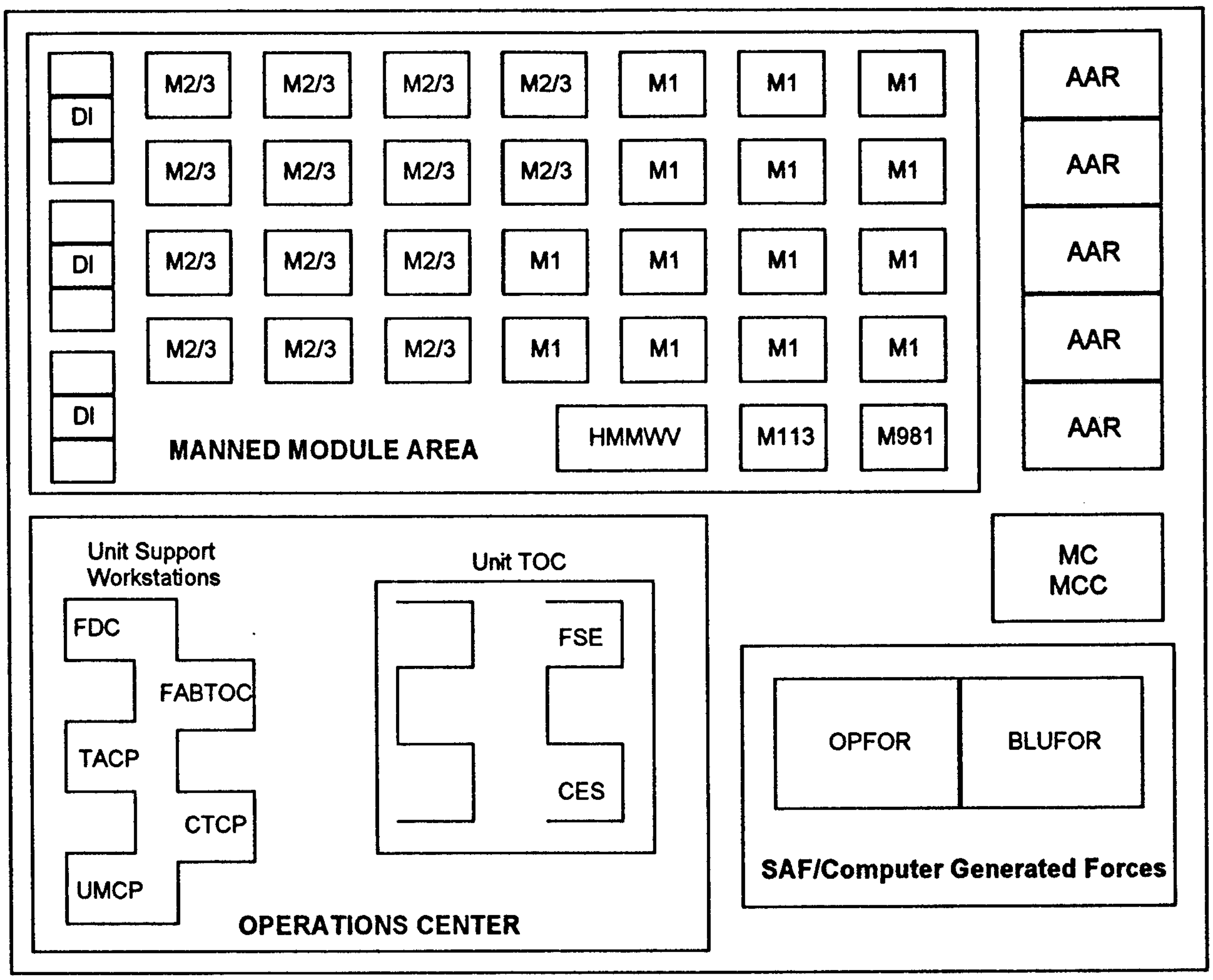


Figure 2. Schematic of typical CCTT Site simulation training area, based on Fort Hood site layout.

As shown in Table 1 and Figure 2, a CCTT Site also includes unit support (or operations center) workstations for each of a tactical unit's combat support (CS) and combat service support (CSS) elements, and semi-automated forces (SAF) workstations to control opposing force (OPFOR) and friendly, or blue forces (BLUFOR), elements.

The CCTT simulation control systems can support the conduct of up to five independent exercises simultaneously, although the allocation of manned modules and other workstations will necessarily limit the types of units that can be accommodated at one time. The training unit provides the workstation operators to control CS and CSS elements. In some cases, these individuals will be the actual position incumbents (e.g., the battalion TF Fire Support Officer [FSO] controls fire support activities from the FSE workstation) and they will be treated as members of the training audience, receiving feedback in the form of AARs along with members of the maneuver units. At other times, these workstations will be staffed by persons whose primary role is to provide the required conditions and cues, but are not considered to be part of the training audience.

The exercise O/C will usually be a member of the unit's higher echelon or an adjacent unit. This person will be responsible for monitoring unit performance, observing the overall flow of the exercise from the "see-all" view at the AAR workstation in order to direct the exercise, and facilitating informal or formal AARs.

CCTT site staff members control the OPFOR and BLUFOR SAF and the MCC and MC components. There are five AAR workstations, where CCTT personnel assist the unit-provided O/C with AAR data collection and presentation.

The CCTT functionality is similar to SIMNET in many respects. However, it includes significant enhancements or improvements that had to be attended to during training design. These differences include features that represent:

- Track commander popped hatch
- Thermal and image intensifier sights
- Binoculars
- Fire support team vehicle (FIST-V)
- Dismounted infantry (DI) modules
- Unit support workstations for CS and CSS
- Machine guns
- Environmental options (day, night, fog)

The M1A2 manned modules have features to replicate the intervehicular information system (IVIS). However, no M1A2 exercises were created as part of STRUCCTT.

There were additional requirements from the SIMUTA design specified in the SOW for the STRUCCTT project. The key requirements, and their impact on STRUCCTT training design, included:

- There is no "dedicated O/C team" provided with CCTT; O/Cs must come from the unit in training.
- Battalion-level CS and CSS functions for all exercises must be provided by support workstation operators who come from the unit in training.

- Multimedia "demonstrations of performance" must be developed to provide exemplars for unit execution of the exercises.
- Completed exercises must be compatible with the Training Exercise Development System (TREDS), a computer-based exercise planning tool.

While the STRUCCTT project was to build on the successful model of similar projects (especially SIMUTA and SIMUTA-B), the configuration and functioning of the CCTT system required a thorough analysis of the method for conducting and supporting structured training. Every part of the TSP and training program had to be evaluated and refined to create worthwhile structured training events for units on the CCTT.

Development Methodology

This section describes in detail the application of the methodology for development of structured simulation-based training (Campbell et al., 1995, Campbell et al., 1997). It provides an overview of the methodology, then details the design and development of the STRUCCTT exercises. While the project followed the methodology as closely as possible, activities did not always occur in the exact sequence described below. The process was iterative, with each action impacting on the products of the actions that preceded or followed it.

Methodology

The methodology for the STRUCCTT work was adopted from the SIMUTA project model, as subsequently expanded in a project named Combined Arms Operations at Brigade Level, Realistically Achieved Through Simulation (COBRAS). It consists of four phases, as shown in Figure 3 (Campbell et al., 1997). Formative evaluation is an ongoing process that is involved during all phases of training development.

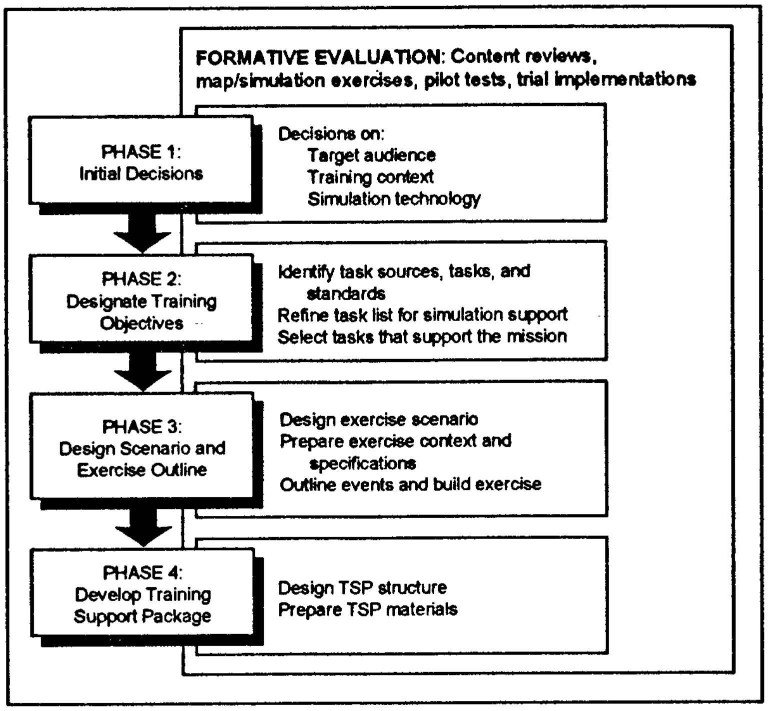


Figure 3. The four phases in the development of structured simulation-based training.

Phases 1 and 2 of the methodology will be discussed as they apply to the design of platoon, company team, and the battalion TF exercises. In Phases 3 and 4, the discussion will focus on the platoon and company team exercises first, and then on the battalion TF exercise.

Phase 1 - Initial Decisions

Many of the initial decisions for the STRUCCTT exercises were specified in the SOW, including:

- The STRUCCTT exercises were to be based on a selected set of exercises from the previous SIMUTA and SIMUTA-B projects, using the same basic missions (MTC, DIS, and DATK) and the SIMUTA/SIMUTA-B OPORDs and overlays.
- The exercises would use the CCTT Primary 2 Terrain Database, which approximates an area that includes the NTC.
- The exercises within each mission (MTC, DIS, DATK) would have a common tactical scenario, task organization, CS, and CSS across echelons and for each unit type. That is, the exercises would be "nested" in every type and echelon of unit training in CCTT.
- Each platoon and company team exercise was to be designed in the form of a table representing segments of the mission; the mission would provide a continuous underlying story line for the tables.
- The battalion TF exercise would not be constructed as tables, but would have predetermined break-points for feedback as needed by the unit in training.

- The platoon and company team tables and the battalion TF exercise would incorporate conditions and cues in such a way that a crawl-walk-run performance progression would be presented.
- Each platoon and company team table would take 2-2 ½ hours to accomplish, from the initial briefing through completion of the AAR. This would allow units frequent breaks from simulators and provide opportunities for frequent performance feedback.
- The battalion TF exercise would take 4-6 hours to accomplish. While this required longer times in simulators, it was deemed necessary in order to allow the scenario situation to develop, and to provide the continuity necessary for correct performance of command and control activities.

The use of material from previously developed exercises satisfied requirements of Phase 1 of the methodology, provided answers that reduced the design/development requirements for the project, and allowed the team to concentrate its efforts on adapting existing exercises to the enhanced operational capabilities of the CCTT. At the same time, analysis of the CCTT features that differed from SIMNET features led to identification of related differences in the exercises themselves. These features and their impact on the STRUCCTT exercises are shown in Table 2.

Table 2

Exercise Impact of CCTT Features

CCTT features	Exercise impact
• Track commander popped hatch, thermal and image intensifier sights, and binoculars	• Visual cues to be presented at greater distances based on improved observation of battlefield; additional tasks
• FIST-V, DI modules, and unit support workstations for CS and CSS	• Additional tasks, subtasks, and task steps and participants
• Machine guns	• Additional tasks
• Environmental options (day, night, fog)	• Variable difficulty levels for each exercise, depending on environmental options

The four additional requirements for the STRUCCTT exercises, described earlier on Page 10, also had impacts on the exercise design. The requirement for units to provide O/Cs and support workstation operators meant that specialized train-the-trainer packages would have to be developed. The TSP materials would also reference the availability of multimedia demonstrations of performance. The TSP material also needed to be formatted in such a way that it could be incorporated into the TREDS exercise planning tool.

Phase 2 - Designate Training Objectives

The existing SIMUTA and SIMUTA-B exercises provided the initial list of tasks to be considered for use on the CCTT. The tasks in these exercises had proven to be doctrinally correct, properly sequenced, and executable and observable in SIMNET. Because of the additional features of CCTT, additional tasks and task elements would also be appropriate, as indicated in Table 2. These tasks were drawn from doctrinal literature (i.e., current field manuals [FMs] and the Army Training and Evaluation Program [ARTEP] Mission Training Plans [MTPs]) for the unit types and echelons prescribed.

A primary consideration was the ability of CCTT to support the execution and observation of the training tasks. After compiling the list of tasks from the SIMUTA and SIMUTA-B work, supplemented by tasks likely to be appropriate for CCTT, developers analyzed the tasks using the methodology developed by Burnside (1990) and the Task Performance Support Codes (TPSC) for CCTT (Sherikon, 1996). Hands-on performance of the tasks in CCTT and careful review of the CCTT system technical documentation provided by the PM-CATT helped to determine if a task should be included.

This allowed developers to screen the tasks and determine if CCTT capabilities allowed units to execute the task steps. It also permitted an examination of O/C procedures for observing and evaluating accomplishment of the task steps. The result of this effort was identification of the tasks, task steps, and performance measures that fit the selected missions and were supported by CCTT.

Phase 3 - Design Scenario and Exercise Outlines

Scenario Design. As mentioned earlier, the team used OPORDs and overlays from SIMUTA and SIMUTA-B as an initial baseline for the tactical scenario development. The existing orders were first reviewed with regard to the new doctrinal guidance for tank platoons (Department of the Army [DA], 1996); the doctrinal guidance for other echelons and unit types had not been changed. Although there was no need for doctrinal changes, the OPORDs and overlays were modified as necessary to ensure that they would provide the appropriate cues for CCTT-specific capabilities and OPFOR specifications.

Another influence on OPORD modifications derived from the requirement that the exercises within each mission (MTC, DIS, DATK) would have a common tactical scenario, task organization, CS, and CSS. As part of this "nested table" concept, each echelon would also be working with the same friendly elements, whether they were computer-generated or fully manned. Additionally, the scenario for each mission type would portray the same OPFOR unit executing the same tactical mission. The OPORDs were revised as necessary to meet these requirements.

The result of this effort was a complete set of tactical OPORDs and overlays that established the context for the execution of the selected tasks. These OPORDs provided the framework for the design of individual platoon, company team, and battalion TF exercises by setting the conditions for specific events which would cue the performance of the tasks. A total

of 14 OPORDs were required to cover the 39 company team and platoon tables and the battalion TF exercise described in the project SOW.

Armor and Infantry School representatives provided additional comments and recommendations for changes to the OPORDs in December 1996. After reviewing the comments and briefing the TSM-CATT Project Officer on the indicated changes, the modified OPORDs were delivered in February 1997.

Company Team and Platoon Exercises. Once the tactical scenarios were established, design work began on the 39 platoon and company team exercises. The design of the battalion TF CFX occurred later in the project and proceeded on a different set of design guidelines. It will be discussed later.

STRUCCTT developers reviewed the Army doctrine for each mission (MTC, DIS, and DATK) to determine the general sequence of tasks, events, or sub-missions making up each type of mission. This task/event sequence was identified based primarily on information in FM 71-2, *The Tank and Mechanized Infantry Battalion Task Force* (DA, 1988b), which provides the most complete overall description of the missions. Platoon and company team doctrinal manuals were not used for this process because they focus on task execution and do not provide a sufficient overview of tactical operations to develop a sequence of tasks that can be linked together to form a mission. Each mission was then partitioned into tables, based on the task/event sequence, for each type (mechanized infantry and/or tank) and echelon (platoon and/or company team). Each mission partition was also examined to determine the effects of or difficulties presented by imposing different environmental conditions (day, night, or fog).

This method of partitioning ensured that a coherent tactical story line was the basis for the set of tables, and that the tables would follow the doctrinal sequence for each mission from the initiation of mission execution through consolidation and reorganization. The layout of the tables provided a training sequence for a unit in a doctrinally correct, tactically logical fashion. Because of the built-in variations in selected dimensions such as terrain, enemy, support elements, and environmental conditions, the tables would allow units to progress from easy to difficult in a crawl-walk-run sequence.

In addition to the mission tables, a set of fundamental tables was also designed. These fundamental tables would allow a unit to practice basic combat skills within a less demanding tactical context as an initial step after CCTT familiarization and before executing the mission tables.

The structure resulting from this design process was a set of platoon and company team table definitions within which units would be able to train according to their needs, as determined by their Mission Essential Task List (METL) and proficiency level. This structure would provide for multiple points of entry depending on the specific unit requirements. A layout of the overall design structure for the company team and platoon exercise set is at Figure 4.

The SOW specified a selected set of SIMUTA tables to be considered for adaptation to CCTT, in order to provide a wide range of tasks across all mission types and to include conditions that would stress all of the CCTT functions. Using the partitioning shown in Figure 4, developers identified the partitions that most closely matched the SOW table listing, and presented the proposed list of CCTT tables to the government for approval.

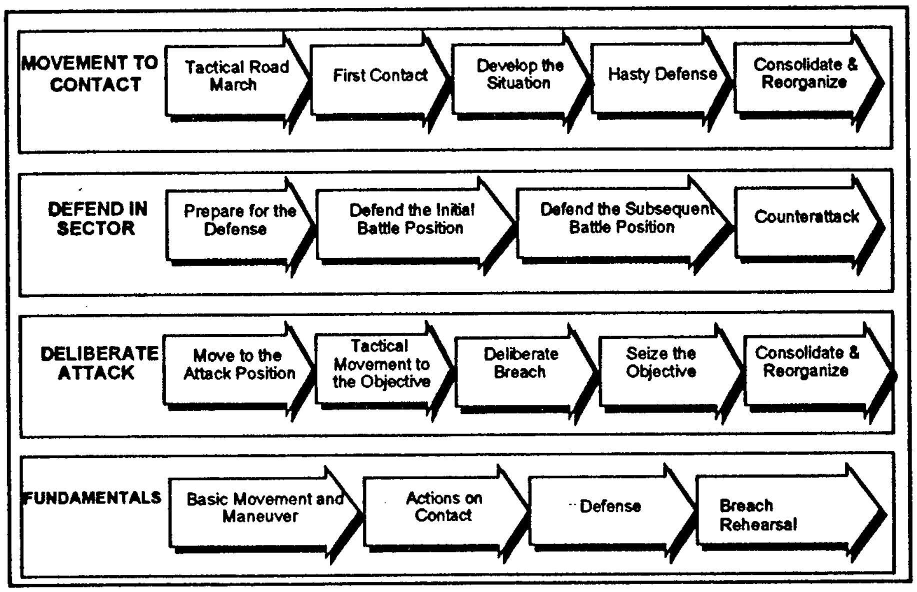


Figure 4. Partitions of the missions and fundamental skills as the basis for platoon and company team tables.

It should be noted that the set of tables to be developed was not comprehensive; that is, some portions of the mission story line would not be represented in the tables. Thus, the STRUCCTT tables and the SIMUTA tables were not entirely congruent, with one-for-one table matches. However, among the set to be developed, there would be sufficient continuity and variety to provide a coherent training sequence and to support the CCTT LUT.

For ease of understanding and reference, an alphanumeric designator was assigned to identify each company team and platoon table within the overall design. Figure 5 illustrates the system used. A list of the tables that were to be developed for the platoon and company team, including the alphanumeric designators, is shown in Table 3.

After approval of the table identification as shown in Table 3, table development and OPORD refinement began. The two processes were conducted simultaneously. The OPORDs were used initially to set the tasks and conditions for the tables. Later, the refined table specifications provided changes to the OPORD paragraphs on task organization, the situation, and execution.

Table 3

STRUCCTT Tables Developed

Unit type and echelon	Table designators	Mission or fundamentals	Table description
Tank Platoon	PAF1D/PAF1N	Fundamental	Tactical movement exercise (day, night)
	PAF3D/PAF3N	Fundamental	Defense exercise (day, night)
	PAM2D/PAM2N	Movement to Contact	First contact (day, night)
	PAM3D/PAM3N	Movement to Contact	Develop the situation (day, night)
	PAD1D	Defense in Sector	Prepare for the defense (day)
	PAD3D/PAD3N	Defense in Sector	Defense of a subsequent battle position (day, night)
Mech Infantry Platoon	PMF1D/PMF1N	Fundamental	Tactical movement exercise (day, night)
	PMF3D/PMF3N	Fundamental	Defense exercise (day, night)
	PMM2D/PMM2N	Movement to Contact	First contact (day, night)
	PMM3D/PMM3N	Movement to Contact	Develop the situation (day, night)
	PMD1D	Defense in Sector	Prepare for the defense (day)
	PMD3D/PMD3N	Defense in Sector	Defense of a subsequent battle position (day, night)
Tank Heavy Company Team	TAF1D/TAF1N	Fundamental	Tactical movement exercise (day, night)
	TAF2D/TAF2N	Fundamental	Actions on contact (day, night)
	TAF3D/TAF3N	Fundamental	Defense exercise (day, night)
	TAD1D	Defense in Sector	Prepare for the defense (day)
	TAD3F	Defense in Sector	Defense of a subsequent battle position (fog)
Mech Heavy Team	TMF1D/TMF1N	Fundamental	Tactical movement exercise (day, night)
	TMF2D/TMF2N	Fundamental	Actions on contact (day, night)
	TMF3D/TMF3N	Fundamental	Defense exercise (day, night)
	TMD1D	Defense in Sector	Prepare for the defense (day)
	TMD3F	Defense in Sector	Defense of a subsequent battle position (fog)
Balanced Company Team	TBK3D	Deliberate Attack	Breach of an obstacle (day)

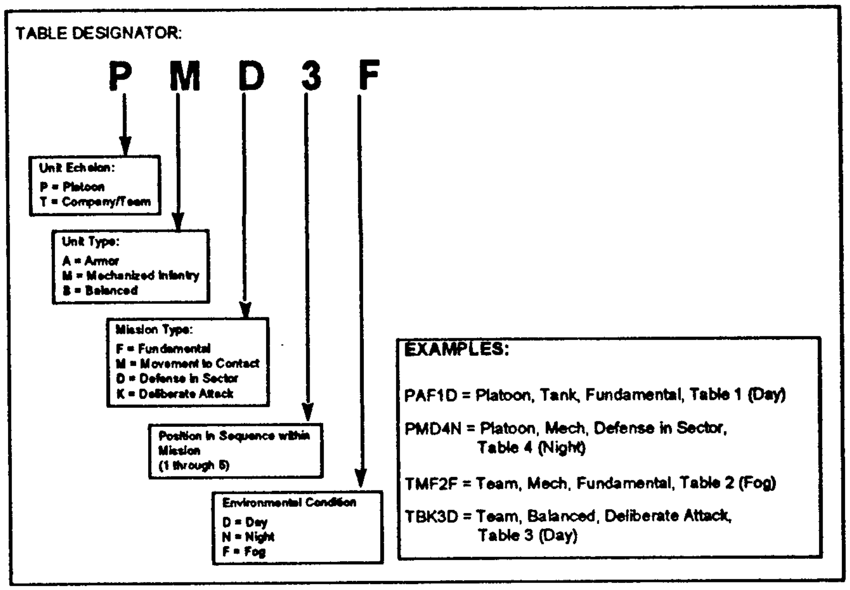


Figure 5. Platoon and company team table designator naming conventions.

The first step was to develop table outlines. Each table outline consisted of four elements, as shown in the example in Figure 6:

- a sketch of the terrain and graphic control measures that would be used in the table,
- a description of the events that would occur in the table,
- the BLUFOR and OPFOR units that would be involved, and
- a listing of the tasks that the table would train with task number and TPSC.

When completed, the outlines served as the basis for the preliminary sequencing of events in each table. By linking the events and the tasks, as shown in Figure 6, the outlines helped to ensure that the exercises would present the conditions necessary to cue soldiers to perform the desired tasks. In addition to providing a common reference point for the developers on what the table scope and specifications would be, the table outlines also served two other purposes for the STRUCCTT project. First, they were used as executive-level summaries of the tables as the development process proceeded, so that the development process could be explained and illustrated for interested audiences. Second, they were used to document the audit trail for changes to tables as they were developed.

Using approved table outlines, the team developed and recorded CCTT initialization data and a tactical story line for each table. Initialization data, recorded on CCTT plan sheets, included detailed specifications about the CCTT-based unit systems, assets, and personnel, including their locations, and their status and readiness levels at the start of the exercise itself. The tactical story line for each table was detailed in the form of an event guide, which provided a step-by-step sequence for the table.

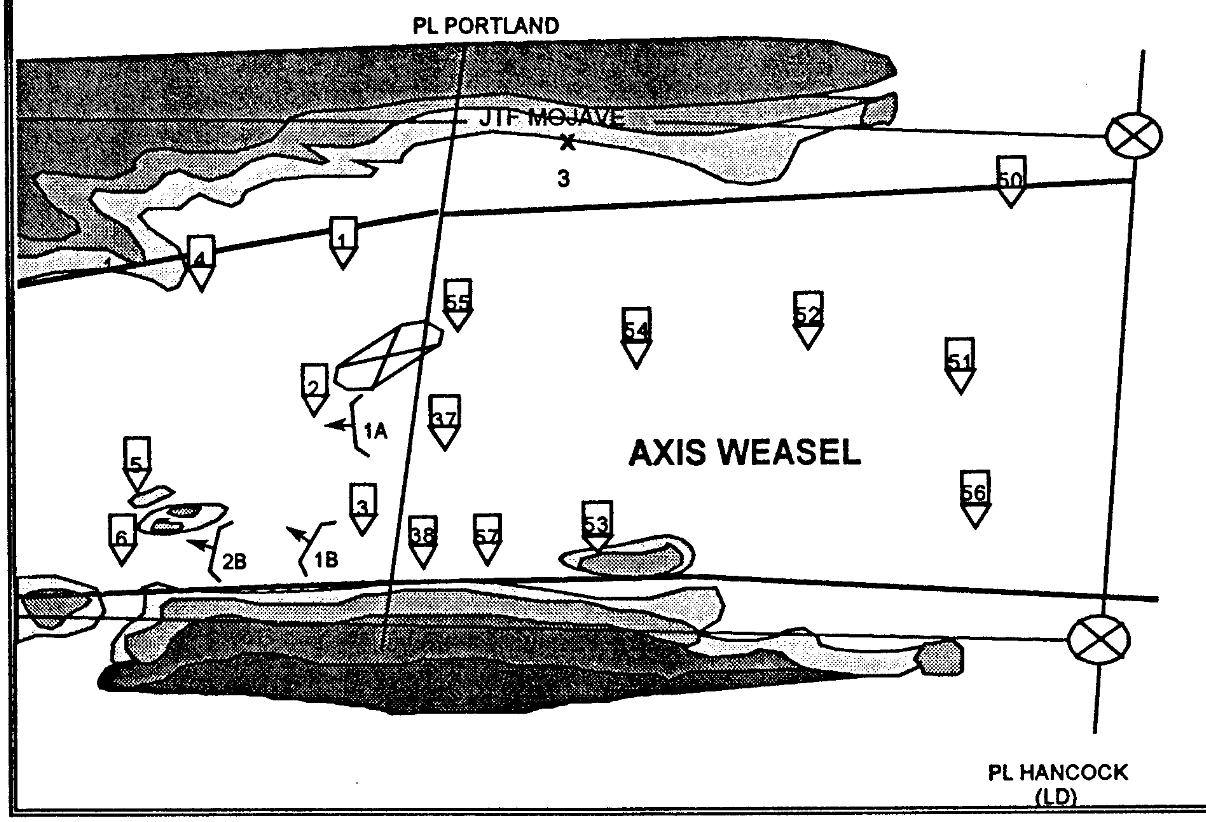
Table 4 shows the major event guide information that was assembled to support TSP development. All of the planned events were thoroughly war gamed before starting any work on the table using CCTT itself. The war gaming process consisted of the project's military subject matter experts (SME) marking the initial starting points of all units, both manned and computer-generated, on an NTC map, and then, by following the event guide, moving the units across the map according to the instructions provided. The SME then evaluated the training unit's ability to accomplish the desired task(s) under the conditions presented. If the unit could accomplish the task(s), the event guide was finalized and initialization plan sheets were finalized. If the unit couldn't accomplish the task, the event guide and other documentation were revised to create the desired conditions.

Table 4

Event Guide Elements

Component	Description
Event	Short descriptive title of the event.
O/C Actions	Provides scripted message or other actions that the O/C will use to cue the execution of the event.
Unit Action	Describes the anticipated unit reaction to the event cue or describes the unit action that will prompt the O/C to provide the next cue.
BLUFOR Action OPFOR Action	Describes the BLUFOR and OPFOR computer-generated force actions that the workstation operators will perform for the event.
Unit Support Workstation Action	Describes the unit support workstation actions that the workstation operators will perform for the event.
ARTEP Tasks and Task Steps	Lists ARTEP-MTP tasks and task steps for each event in the table.
AAR observation	Notes of instructions and guidance for the O/C and the AAR workstation operator to assist in observing unit performance. Examples: • How and where to be positioned to observe, in terms of perspective (enemy or friendly) and direction (from behind, at an angle, etc.) • What to listen for (spot report, fire commands) • What to look for (engagements, position of wingmen).

Table Outline: PAM2_: First Contact



1. The tank platoon maneuvers with the lead team in a task force MTC. This table focuses on tactical movement and actions on contact.

2. The table begins with the platoon crossing PL HANCOCK. As it continues to move it encounters an OPFOR element consisting of a BMP platoon, air defense section, and an anti-tank guided missile (ATGM) squad. An OPFOR atk helo section* also attacks the platoon. The table ends when the platoon completes its actions on contact and reports its status.

TASKS (ARTEP 17-237-10-MTP, JUL 96)

TASKS	TASK #	TPSC
Conduct Tactical Movement	17-3-1016	3
Execute Actions on Contact	17-3-0221	4
Contact Drill	Battle Drill 2	4
Action Drill	Battle Drill 3	4
React to Air Attack*	Battle Drill 5	4

* Day only

Figure 6. Sample platoon table outline.

After the initialization plan sheets and story lines were developed, developers built the CCTT electronic exercise files. This effort proved to be the most difficult portion of the project. The simulation system itself was still evolving, and the STRUCCTT team had to rely on the CCTT developers for assistance. Software was constantly changing (nightly, in fact) and the exercise files had to be revised in accordance with those software changes. CCTT developers were very forthcoming with information and assistance, but their primary focus was on preparing the system for the LUT. As mentioned before, early development took place at the LMTEF in Orlando and at Fort Knox. The creation of exercise files progressed very slowly until the Fort Hood CCTT system was operational. This is when the developers, site support contractors, and the STRUCCTT Team were able to begin working together on the development of the tables in preparation for the LUT.

Table 5 contains a list of the steps required to build and test an exercise in the CCTT. The documentation of this process grew out of the team's exercise building efforts. The process and its outcomes had not been recorded prior to the STRUCCTT project efforts. The team learned much of the process by means of informal conversation with the system developers, and frequent trial and error.

As each table was created, it was tested by the STRUCCTT developers to insure that it would execute as designed. Based on the performance of the table, the supporting documentation and electronic files were modified and the table was tested again. Once satisfactory operation of the tables was demonstrated in the Fort Hood CCTT Site, the electronic files were placed in a protected directory under the control of the PM-CATT Project Engineer for use during integration testing at Fort Hood and subsequent use during the LUT.

Battalion TF Exercise. The battalion TF exercise was to be an MTC from the assembly area to the objective. The design of the battalion TF exercise followed guidelines similar to those used in the company team and platoon tables, except that no explicit "tables" were to be designed. The crawl-walk-run concept was accomplished by designing the exercise with the simplest tasks first, then repeating them under more difficult conditions or with more complicated tasks. Actual execution time was projected to be four to six hours. The terrain for the mission was the NTC central corridor where MTC is typically executed in the live training environment.

As fielded at Fort Hood during this project, the CCTT Site had only enough manned modules to support simultaneous training for a mechanized infantry heavy company team and a tank heavy company team when all of the teams' combat vehicle crews participate. As a result, various "workarounds" were necessary in order to provide the desired training at battalion TF level. The battalion TF exercise relied upon the use of the command-from-simulator (CFS) feature of CCTT to represent the combat forces (tank and mechanized infantry) normally found on the battlefield. CFS can replicate all combat vehicles below the platoon leaders in SAF. These vehicles are attached or "tethered" to the platoon leaders, with BLUFOR operators controlling the maneuver (formations) and firing (competency, range, and fire/no fire) of the vehicles. In this way, all the maneuver elements of a full battalion TF can generally be emulated, with unit support workstation operators providing CS and CSS. Some players had to be placed in non-doctrinal

Table 5

Steps in Building CCTT Exercise Files

Overlay Development & Building

- Accomplished at AAR or SAF workstation (*2-4 hours*)
  - ✓ Focus is parent (TF) graphic control measures (GCM)
  - ✓ SAVE OVERLAY FILE

Establish Exercise Conditions

- Accomplished at MCC/MC via Exercise Planning mode (*1-2 hours*)
  - ✓ Establish category & file name
  - ✓ Order identification
  - ✓ Terrain database
  - ✓ Weather
  - ✓ Removal of unnecessary air sorties/missions
  - ✓ Communications setup:

    Assign all appropriate nets (radio presets)

    Designate/assign a SAF net

    Set radio presets for manned modules/assign both radios

    Set radio presets for workstations (AAR, Unit Support, SAF) required for the exercise
  - ✓ Command (Unit Support Workstations) designation
  - ✓ Task organization/hierarchical relationships must be considered/system constraints (supportability) must be considered
  - ✓ SAVE EXERCISE FILE

Exercise File Refinement

- Accomplished at SAF workstation (*1-2 hours per side*)
  - ✓ Link exercise (BLUFOR/OPFOR from Exercise Planning) to baseline GCM overlay
  - ✓ Refine task organization/ensure that all necessary attachments, detachments, controls, etc. are induced
  - ✓ Fire parameters/set parameters (range, competence, altitude, etc.) to match exercise plan sheet guidance
  - ✓ Modify baseline GCM overlay to include SAF specific requirements (control measures) for use in combat instruction sets (CIS) development
  - ✓ SAVE OVERLAY FILE(S)
  - ✓ Assign CIS & any additional control requirements
  - ✓ SAVE SAF EXERCISE FILE(S)

Dynamic TDB Features

- Accomplished at MCC/MC (*1-2 hours*)
  - ✓ Add synthetic environment features (fighting positions, wire, minefields, etc.)
  - ✓ SAVE EXERCISE FILE

Exercise Build Completion

- Accomplished at any workstation (*5 minutes*)
  - ✓ Review exercise file structure & obtain entity counts

vehicles (e.g., FSO placed in a BFV). With these "workarounds," the battalion TF exercise would allow the battalion TF (platoon leaders and above, with crews, and battalion TF staff) to maneuver against an enemy force (based upon historical planning ratios) in the simulation, providing opportunities to train complex command, control and communications tasks and to have leaders execute their tasks in a doctrinally correct setting.

To provide platoon leaders the opportunity to practice command and control skills with this type of workaround force before participating in the exercise itself, the STRUCCTT Team modified the company team tables to be used as part of the train-up for the battalion TF CFX. These practical exercises could be used for four types of company team-level organizations (tank company, mechanized infantry company, tank heavy company team, and mechanized infantry heavy company team), and gave company or company team commanders and platoon leaders the familiarization training needed to participate in the battalion TF CFX.

The MTC OPORD from the development efforts for the platoon and company team tables was used for the battalion TF exercise. Since the basic order already existed, developers verified the scenario, then segmented the exercise. The segmenting provided convenient points where the exercise could be stopped for interim AARs. It was accomplished based on the sequence of events for an MTC as presented in FM 71-2 (DA, 1988b) and on natural breaks in enemy formations conducting similar operations as presented in the Heavy Opposing Force (OPFOR) Tactical Handbook (TRADOC Pamphlet 350-16, DA, 1994).

Once the layout of the exercise was completed, the actions of the individual battalion TF staff elements and subordinate units were identified. ARTEP-MTPs provided the tasks that could occur, and developers decided when they should occur. Because of variations in the way a battalion TF might react to situations during the battle, and due to the automatic and spontaneous capabilities and reactions of OPFOR and BLUFOR elements, some flexibility was allowed in defining the timing of events and task performance. This was needed to provide the proper balance between a rigidly constrained training experience and a free-play exercise.

Developing the battalion TF exercise followed a process similar to the one used in the development of the company team and platoon tables. Developers documented the initialization data for all forces using CCTT plan sheets. Having laid out the basic outline of the exercise, developers determined where OPFOR activity and critical information flow needed to occur in order to cue the tasks. This led to the tentative placement and timing of OPFOR elements and the proposed scripted messages for the event guide.

The building of the battalion TF exercise files was conducted at the Fort Hood CCTT Site and followed the process used in the platoon and company team development effort. The initialization data recorded on plan sheets was used to build the exercise file. The event guide that included the desired enemy actions was used to build SAF instruction files. As before, the entire exercise was tested and modified to ensure the required events occurred as intended by design.

Phase 4 - Develop Training Support Packages

Development of the TSPs was an evolutionary process. Beginning with the basic TSP structure from SIMUTA-B, adaptations were introduced to make a similar structure suitable for use in a CCTT environment. The exercises and the TSPs went through a series of changes induced by discoveries of how the CCTT system actually operated, examining alternative ways to present the materials, and attending to feedback from the site and units.

Training Support Package Guidance and Constraints. There were many guiding documents available for reference to the training development team in designing the overall TSP structure. Two in particular provided the framework around which the STRUCCTT TSP macro-structure was formed. These were TRADOC Regulation 350-70 (DA, 1995), and the previous development work of the SIMUTA/SIMUTA-B team as described in Campbell et al. (1995), Hoffman et al. (1995), and Graves and Myers (1996) and exemplified by the TSPs created as part of SIMUTA-B.

TRADOC Regulation 350-70 (DA, 1995) specifies no format for collective training TSPs (also called WARFIGHTER TSPs), but it does identify five major components that TSPs must include. The STRUCCTT TSP was constructed to include those components, which are described in Table 6.

A review of all the TSP references resulted in the following directing principles for the preparation of the materials that would comprise the TSP:

1. "Stand-alone" parts: Portions of the TSP for different users should be useable without the need to refer to all of the other parts.
2. Expandable, organized whole: The TSP structure should allow for expansion as new exercises are developed.
3. Applicable to other environments: TSPs should be useable (once environmental differences are considered) in other applications (e.g., live).
4. Linkage between tables: TSPs should support and facilitate the tactical and operational flow of tables.
5. Ease of execution and use: TSPs should be user friendly.
6. Fit with previously designed TSPs: TSPs should be similar in appearance and structure to similar simulation-based exercise TSPs in order to facilitate use by simulation site staff and users.
7. Uses: TSPs must be useable both as instruction tools, and as a basic reference.
8. Compatability: TSP materials should be compatible with TREDS and other Army TSP repositories (After completion, TSP materials were provided for inclusion into TREDS).

Table 6

STRUCCTT TSP Components

Component[1]	Content	Purpose
Unit Preparation Materials	Table outlines, multi-media demonstrations	Explanation of what tasks and events will occur in a table.
Tactical Materials	Operations orders (OPORDs) and overlays for all tables	Context for the exercise tables.
Administrative Materials	Table materials (event guides)	Basic layout of the table flow.
Trainer Materials	Table preview materials, workstation guidelines, and observation materials	Instructions for training support personnel and a format for recording unit performance.
Simulation/ Environment Materials	Electronic files, table plan sheets	Baseline information concerning entities in the simulated battlefield as well as the command and control options for them.

[1] As required by TRADOC Regulation 350-70.

The biggest difference between previous projects (SIMUTA, SIMUTA-B) and STRUCCTT was the requirement in STRUCCTT to provide a "train-the-trainer" component to the TSP. This was needed in light of the requirement that training units provide O/Cs and the support personnel to operate unit support workstations that replicate CS- and CSS-type exercise support. In contrast, the SIMUTA and SIMUTA-B project developed exercises for SIMNET which had a resident O/C independent of the training unit. This significantly altered the overall TSP framework. Lack of a dedicated O/C team meant that the entire exercise process, from unit preparation through AAR, had to be presented to soldiers designated to serve as O/Cs. It was also necessary to provide a detailed event guide, containing the specific cues to prompt the appropriate tactical responses from the participants, as had been done for O/Cs as a part of the SIMUTA and SIMUTA-B TSPs.

In addition, the actions at the individual unit support workstations required specific instructional materials, which were developed as the battle flow was identified. Guidance was developed which generally supported the actions of the unit in accordance with the OPORD and the results of the war gaming efforts. These guidelines were documented and became "execution guidelines" for the workstation operators.

The team used a structured writing approach to present instructional materials other than tactical materials such as OPORDs. This decision was based on the success of this technique in the SIMUTA-B Project. Structured writing provides a method of combining instructional analysis, organization, and presentation into an integrated process. The STRUCCTT project used

the same software package as SIMUTA-B, in which Information Mapping® served as a supplement to Microsoft Word® and provided the structured writing formats used in the TSPs.

The TSP developed is simulation-specific and user-oriented. It provides all of the materials, instructions, and electronic files required to plan, prepare for, and conduct structured training on the CCTT. It is considered a starting point for the creation of other training exercises and will undoubtedly change as units and training developers become more experienced with the CCTT and learn how to use the system to its full capability.

Company Team and Platoon Training Support Package. The STRUCCTT Team and platoon TSP design was a very close copy of the SIMUTA-B TSP model. It contains all the components identified by TRADOC, but these components are CCTT system-specific and are user-oriented rather than organized by topic. The overall company team and platoon TSP design is shown in Table 7.

Battalion TF Training Support Package. Initially, the battalion TF TSP was to be a simple addition to the company team and platoon TSP. However, the complexity of the battalion TF exercise and the essential differences between it and the platoon and company team tables indicated that a separate TSP was needed. Consequently, a structure based on the three groups of participants (unit, O/C, and CCTT site) was used to create the separate TSP set. It included specific instructions for assembling individual workbooks for controllers and workstation operators, containing information and guidance specific to their roles. The design for the battalion TF TSP is shown in Table 8.

Design of the Train-the-Trainer TSP Materials. Design of the train-the-trainer portion of the TSP followed an instructional systems design (ISD) approach (Kemp, 1985) for individual training. Like the rest of the STRUCCTT material, this part of the TSP presumed an adequate level of competence and familiarity with the CCTT system. However, initial system familiarization training was being provided separately from the STRUCCTT TSP by means of four other programs, including:

- Education of CCTT through Computer Assisted Training Technology (EDUCCATT), a training program developed by PM-CATT to provide unit support workstation operators hands-on experience on the functions and capabilities of the CCTT workstations;
- Familiarization Course, a PM-CATT developed practical exercise designed to orient combat vehicle crews with the functions and capabilities of their manned module while operating in a virtual environment;
- Workstation Operator Guides, PM-CATT developed technical manuals that provide a description of the workstation, an explanation of workstation functions, and operating procedures; and
- Site SOP, a locally developed guide to the administrative requirements for units training in CCTT.

Table 7

Company Team and Platoon TSP Design

Volume	Title	Contents
I	Overview and Preparation Guidance	Overview and Background of Structured Simulation-Based Training Training Unit and CCTT Site Responsibilities Unit Guide: CCTT Training Management Strategy, Training Decisions, Exercise Phases, Unit Responsibilities Checklist CCTT Site Guide: Pre-Exercise Responsibilities, Exercise Preparation Responsibilities, Exercise Execution Responsibilities, Post-Exercise Responsibilities, Site POC Responsibilities Checklist, System Requirements Charts Appendixes • Acronyms • Standard Force Organization and Structure • Fundamentals: Mission Summary • Movement to Contact: Mission Summary • Defense in Sector: Mission Summary • Deliberate Attack: Mission Summary
II	Company Team and Platoon Train-the-Trainer Material	Roles and responsibilities for • Observer/Controller • Workstation Operators: • AAR • OPFOR • FABTOC • MCC • FSE • CES • BLUFOR • FDC • TACP • UMCP
III	Company Team and Platoon Fundamental Exercises	Tactical and training support materials necessary to prepare for and execute the Fundamental training exercises.
IV	Platoon Movement to Contact Tables	Tactical and training support materials necessary to prepare for and execute the MTC training tables.
V	Company Team and Platoon Defense in Sector Tables	Tactical and training support materials necessary to prepare for and execute the DIS training tables.
VI	Team Deliberate Attack Table	Provides the tactical and training support materials necessary to prepare for and execute the DATK training table.

Table 8

Battalion TF TSP Design Layout

Part	Title	Contents
I	Training at the Battalion TF Level	Introduction to Battalion TF Level Training Organization for Training Managing and Executing Battalion TF Level Training
II	Training Unit Roles and Responsibilities	Training Participant Roles and Responsibilities Unit Support Workstation Operator Roles and Responsibilities
III	CCTT Site Roles and Responsibilities	Role and Responsibilities for: AAR Workstation Operator MCC Workstation Operator BLUFOR Workstation Operator OPFOR Workstation Operator
IV	O/C Team Roles and Responsibilities	O/C Team Organization and Structure Role and Responsibilities for: • Senior O/C • Exercise Controller • OPFOR Controller • Main CP/S3 O/C • S2 Section O/C • Engineer O/C • Company team O/C • Scout O/C • Combat Trains Command Post O/C • Fire Support Element O/C • Higher Headquarters Cell Controllers
V	Battalion TF MTC (TFAM) Exercise Guide	Specific instructions for the setup and execution of the exercise Pre-Execution and Execution phases
	Appendix A	Acronyms
	Appendix B	Brigade OPORD and Overlay
	Appendix C	Battalion TF OPORD and Overlay
	Appendix D	Communication Materials
	Appendix E	Battalion TF Supporting Documentation
	Appendix F	Workstation Execution Guidelines
	Appendix G	Exercise Observation Forms
	Appendix H	Exercise After Action Review Materials
	Appendix I	Command From Simulator Practice Exercises
	Appendix J	Workstation Practical Exercise
	Appendix K	Battalion TF Movement to Contact Task Chart

In order to provide a user-friendly and synchronized training system, great care was exercised to ensure that the initial systems familiarization training and the structured training program meshed, or at least did not conflict. STRUCCTT developers worked with developers and managers of the other systems to identify the content and training objectives and insure that the STRUCCTT train-the-trainer materials provided the logical next step in the training process.

Because of the possibility of having many new operators and the need to provide instruction that could also serve as a reference, the internal layout of the STRUCCTT material was of considerable concern. To ensure the user would have a limited requirement to seek out other information during training, each section of this part of the TSP was designed to stand-alone. While this created a degree of redundancy of information, the result in execution allowed individuals to concentrate their learning in a single source, provided training for multiple persons simultaneously with no requirement to share resources, and facilitated reproduction and accounting for materials.

The train-the-trainer volume for the company team and platoon tables was designed as indicated in Table 7. The various parts represent separate sections for the O/C and for each of the different unit support workstation operators. Each section was designed with a similar structure, with particular emphasis given to the workstation operator's roles and responsibilities in preparing for and performing during an exercise. Since the train-the-trainer materials for the various unit support workstation operators are in separate sections, only those portions required for a particular table need to be used at any one time. The exception is the O/C section, which provides additional instruction for O/C duties, especially during the AAR. Actual job aids, tools, and examples from the exercises are included to ensure a more complete understanding by the person in training. For the same reason, reminders and references to other TSP locations are presented wherever additional information is relevant and important. Finally, each person's section ends with a summary sheet that reviews that person's duties before, during, and after an exercise, and serves as a checklist for use during the exercise preparation and conduct.

The train-the-trainer materials for the battalion TF exercise are organized somewhat differently (consisting of Parts I-IV as shown in Table 8), but contains information similar to that in the company team and platoon materials. The most significant difference is that the unit support workstation operators are not given specific guidelines. In a battalion TF exercise, these unit members work directly for the battalion TF and execute activities that support the battalion TF scheme of maneuver.

Throughout the development of the train-the-trainer materials, STRUCCTT developers kept in contact with the developers of the workstation introductory/familiarization training to make sure that the STRUCCTT train-the-trainer materials accurately reflected the content and intent of the training packaged. As the train-the trainer materials neared completion, the STRUCCTT Team provided the Fort Hood CCTT Site contractor logistic support (CLS) personnel with draft copies for review and comment. Feedback from the CCTT Site indicated that the materials did not provide enough opportunity to practice table execution skills. This was a particular concern in the case of the workstations operators, who had no chance to work with each other in the context of an actual exercise. The STRUCCTT team developed a special

Workstation Practical Exercise (WPE) for the TSP to provide an opportunity for the workstation operators to practice working together, and to provide a gauge of their proficiency prior to participation in a regular exercise.

The WPE was developed as a modified version of one of the company team tables. It provides opportunities for one, many, or all of the workstation operators to utilize their operator skills within the context of an exercise. It does not require a unit in training, since SAF replicates combat forces. The AAR workstation operator controls the exercise and provides the communication cues necessary for the other operators to perform their duties.

Design of the Demonstrations of Performance. The initial requirement for the demonstrations of performance in the SOW was to show a way to perform each exercise. They were to be used as:

- Unit preparatory materials: to introduce the exercises to the users and allow discussion, practice, and augmentation of rehearsals:
- Table previews: to provide a visualization of what was expected, just prior to unit execution: and
- AAR support: to show the unit what they could have done, in comparison to what they did.

The early configuration description of CCTT hardware included a personal computer with a typical hardware and software configuration in the AAR workstation. The decision was made to design and develop the demonstrations of performance as multimedia examples of task performance for the CCTT exercises which would be useable and executable on that personal computer. The intention was to create a CD-ROM (compact disk, read only memory)-based product, utilizing the latest available commercial software. The demonstrations would combine visuals, sound, and video to create a multimedia product, executable without the need for additional software. Demonstration design elements are found in Table 9.

Table 9

Performance Demonstration Design Elements

Component	Description
Video	A "stealth" view from the AAR monitor of CCTT action, converted to video home system (VHS) tape, then digitized into multimedia software
Animation	Plan View Display (PVD) maps, CCTT overlays, and graphic symbols combined to illustrate action
Audio	Voice recordings on platoon and command radio nets, narration dialogues, and sound effects from CCTT simulators
Screen Text	Text for video and animation support (titles and task steps)

The personal computer was eliminated, however, from the current CCTT design after development of the demonstrations began. See Appendix C for details of this effort.

Formative Evaluation Strategy and Results

Formative evaluation was an ongoing process during the design and development phases of the STRUCCTT Project, culminating in observation and data collection during the LUT. This section of the report describes the formative evaluation process at all stages, and presents the results of the evaluation conducted during the LUT.

Evaluation Design and Development

Evaluation and revision were part of a continuous process during the exercise and TSP design and development phases. All aspects of the effort were subject to examination, including tactical materials, tactical story line details, TSP structure and materials, and performance demonstrations. Significant in-progress changes, resulting from the examinations included the modifications to the tactical OPORDs, described earlier, and the overlays previously developed for SIMNET exercises. The coordination of the revisions and refinements ensured the platoon, company team, and battalion TF orders were consistent, allowing units to train in every tactical echelon on the same mission.

The developers tested each table as it was created in the CCTT to ensure that it would execute as designed. Subsequent observations of the tables as they were executed by units caused further changes, as did examination of alternative ways to present tasks to units. With each change, the team modified the supporting documentation and electronic files and retested the table. Once testing of the tables in the Fort Hood CCTT site was complete, the electronic files were placed in a protected directory for use during integration testing at Fort Hood and for subsequent use during the LUT.

Final Formative Evaluation During LUT

Development of the formative evaluation tools for use during the LUT began upon completion of the TSP. Table 10 provides the three prescribed processes for the formative evaluation. During each table a STRUCCTT developer would observe table execution, focusing on the tactical flow of the table and the effectiveness of the TSP supporting the exercise. Following each table (after the AAR), a questionnaire was administered to all participants to obtain their perspective on the quality of the table. Finally, at the end of each two week session, the STRUCCTT team conducted a group interview ("hotwash") with each unit to get their impressions of the overall program.

Table 10

Formative Evaluation Processes

Process	When initiated	Participants	Focus
Observation	During each table	Observation by STRUCCTT developers	Validate/verify table execution as written
Survey	After each table	Administered to unit members, O/Cs, workstation operators	Quality of table preview, execution, and AAR process and materials
Interview (Group "hotwash")	After each two week cycle	Conducted by STRUCCTT developers with unit members and O/Cs (separate sessions)	Overall impressions and general comments on the program of exercises and TSP

The schedule for the LUT included four company-sized units: two tank company teams and two mechanized infantry company teams. Due to scheduling difficulties, one of the tank company teams and one of the mechanized infantry company teams came as pure companies, each minus a platoon. In each case, a SAF platoon replaced the missing platoons in the company team tables, as allowed by the system. Each LUT company team was scheduled for two weeks of training at the CCTT site. The first test company team (the pure mechanized infantry company team [minus]) started in late April 1997. It was followed by the combined arms mechanized infantry company team, the pure armor company team (minus), and the combined arms tank company team, which finished the test exercises in late June 1997. Generally, each unit participated in familiarization training, executed a pretest company team table, conducted a series of five platoon tables and six company team tables, then reran the pretest table as a post-test evaluation of their training progress. Not included in the test were 12 platoon tables and four company team tables, due to the LUT design.

The methodology as laid out in Campbell et al. (1995) recommends a develop-test-revise-retest approach to the formative evaluation process. Because the Test and Experimentation Command (TEXCOM) was using the LUT to evaluate CCTT, it was not possible to completely execute the test phases during the LUT. The STRUCCTT staff was able to collect some observation data about each of the tables, but was unable to collect data about every use of every table. Additionally, it was not always feasible to obtain completed surveys from all participants on all tables nor to gather participants together for hotwash sessions if TEXCOM required them for other evaluation activities.

Another consequence of performing the formative evaluation during the LUT was that the exercises revision and retesting phases could not be executed. Making changes to the exercises based on early feedback and then evaluating the effect of the changes would have been the normal approach to conducting a formative evaluation. The LUT, however, was not to be a formative evaluation and making changes during the LUT would have been equivalent to changing CCTT hardware or software, invalidating the test.

The questionnaire for unit personnel addressed the three parts of just-completed tables: (a) Table preview, (b) Exercise execution (actual conduct of the table), and (c) the AAR. The survey also asked for an evaluation of the time allocated to each of those activities. Table 11 shows the total number of surveys filled in at each echelon level, by type of unit. The number of soldiers completing the survey at the end of any one table ranged from 8 to 42. The lower numbers are a result of efforts to minimize interference with the LUT data collection.

Table 11

Survey Response Rates for Unit Personnel

	Platoons		Company teams	
	Armor	Mechanized Infantry	Armor	Mechanized Infantry
Surveys Completed after Conduct of an Exercise	316	245	211	379

Table 12 shows the units and tables for which the evaluation team conducted observations, surveys, and hotwash discussions. The missing entries in the table are due primarily to the requirement not to interfere with LUT activities. The problems or issues noted by the observers and hotwash discussions provided the basis for the revisions to the tables. The information obtained through the questionnaires supported those observations.

The data summaries in this section are presented in two parts with the first combining the echelons involved in the LUT at platoon and company team levels. The second part briefly discusses data obtained from a battalion task force trial which was not part of the LUT. The STRUCCTT Team observations provide the primary basis for the discussion with the corresponding survey data providing support.

Platoon and Company Team Results

Overall, results of the formative evaluation were favorable with regard to the tables providing a positive training opportunity. The observations for both the platoon and team level training noted the training occurred as intended, with few significant revisions to the exercises. The most prominent revisions, which will be discussed in more detail later, focused on increasing OPFOR effectiveness. Table 13 provides the results of the responses received from the vehicle commanders, unit support personnel, workstation operators, and O/Cs participating in the post training cycle group "hotwash" and survey.

Table 12

Participation in Formative Evaluation During LUT

	Table					
Platoon ID	PAM2D	PAM3D	PAF3N	PAD1D	PAD3D	
Armor Team 1, Platoon 1	✓	✓	✓	✓		
Armor Team 1, Platoon 2	✓		✓	✓		
Armor Team 2, Platoon 1	✓	✓	✓		✓	
Armor Team 2, Platoon 2	✓	✓	✓	✓	✓	
Mech. Team 2, Armor Plt.	✓	✓	✓	✓	✓	
Platoon ID	PMM2D	PMM3D	PMF3N	PMD1D	PMD3D	
Mech Team 1, Platoon 1	✓	✓	✓	✓	✓	
Mech Team 1, Platoon 2	✓	✓	✓	✓	✓	
Mech Team 2, Platoon 1	✓	✓		✓	✓	
Mech Team 2, Platoon 2		✓				
Armor Team 2, Mech Plt.	✓	✓		✓		
Team ID	TAF1D	TAF1N	TAF2N	TAD1D	TAF3N	TAD3F
Armor Team 1		✓	✓	✓	✓	✓
Armor Team 2	✓	(a)	✓	✓	✓	✓
Team ID	TMF1D	TMF1N	TMF2N	TMD1D	TMF3N	TMD3F
Mech Team 1	✓	✓	✓	✓	✓	✓
Mech Team 2	✓	(a)		✓	✓	✓

Note: (a): No questionnaires were administered, but an observation record was filed.
✓= data were collected on this table

After the two week training cycle was complete, the unit members were asked how they would rate their unit's proficiency level prior to and after conducting the exercises. Review of Table 14 clearly shows a shift in the distribution of the responses, indicating the units felt there was an increase in overall task proficiency. Approximately 23% of the respondents felt the level of increase in their unit task proficiency rose two levels (e.g., from marginally to considerably) during the training period.

Table 13

Unit Survey Responses on the Overall Training Program Usefulness

Usefulness of...	No use	Not very useful	Of use	Considerably useful	Extremely useful	N/A
Preparatory materials	2%	5%	41%	26%	20%	6%
Pre-Exercise training at site	0	7%	48%	28%	14%	3%
Train-the-trainer materials	0	7%	30%	20%	5%	38%
Computerized Workstation Training	0	2%	34%	21%	8%	35%
CCTT Workstation Practical Exercise (WPE)	0	0	31%	31%	14%	24%
CCTT Exercise:						
Pre-exercise activities	0	0	44%	43%	7%	6%
Exercise execution	0	3%	39%	41%	15%	2%
Post exercise activities	2%	2%	38%	31%	26%	1%

Note. NA = no answer

Table 14

Unit Survey Responses on Overall Unit Task Proficiency

Unit proficiency...	Not very	Marginally	Moderately	Considerably	Extremely	N/A
Before the exercises	15%	25%	46%	13%	0	1%
After the exercises	2%	7%	41%	48%	2%	2%

Note. NA = no answer

On the post-exercise survey, the first question concerned the table preview. This included a presentation of the tactical situation, the tasks to be trained, and the battle rehearsal and terrain reconnaissance conducted at the AAR workstation. A summary of the responses are generally positive (Table 15), with 6% indicating no revisions are necessary. Of those respondents indicating revision was needed, the reconnaissance component of the preview received 36% of the responses for revision. The other two components, review tactical situation and tasks, received similar responses of approximately 32%. The few comments documented from the observers regarding the table preview focused on an administrative aspect of the training (e.g., unit omitting the task review, enlarging the task list chart).

Table 15

Unit Survey Responses on Table Previews

Q: Should the preview be revised?	Tank platoon	Mech platoon	*Platoon (all)*	Tank team	Mech team	*Team (all)*	Tank units	Mech units	*Overall*
A lot, some, or a little	27%	42%	*33%*	36%	31%	*33%*	30%	36%	*33%*
No	67%	51%	*61%*	62%	60%	*60%*	65%	56%	*60%*
Not sure	6%	7%	*6%*	2%	9%	*7%*	5%	8%	*7%*

Table 16 provides responses with regard to the time allowed for troop leading activities prior to exercise execution. The chart combines the data from both the observers (actual average time for the activity) and the surveys. Several observer and interview comments, particularly those of the O/Cs during team-level exercises, noted the desire for additional time to conduct troop leading procedures. Though the responses are generally positive, over one third of the participants believe there should be more time available for this activity. Perhaps consideration should be given by the site to plan some additional time or recommend the unit spend more time off-site in preparation for the following day's training activities.

Table 16

Unit Survey Responses on Amount of Troop Leading Time

Q: Time provided for troop leading procedures and preparation	Tank platoon	Mech platoon	*Platoon (all)*	Tank team	Mech team	*Team (all)*	Tank units	Mech units	*Overall*
Average time (minutes)	22	14	*18*	19	21	*20*	-------	-------	-------
Too little	30%	32%	*31%*	57%	27%	*38%*	41%	29%	*35%*
About right	66%	62%	*64%*	37%	68%	*57%*	54%	66%	*61%*
Too much	1%	2%	*2%*	3%	2%	*2%*	2%	2%	*2%*
No response	3%	4%	*2%*	3%	3%	*3%*	2%	3%	*2%*

The following series of tables, Tables 17-19, provide detail about the responses from the training participants regarding revisions to the exercises. The observations of the exercises in general provided positive responses and the survey data in the following tables support those observations. An additional comparison of the data investigated differences between three classifications of training participants: unit leaders (includes O/Cs), crews, and workstation operators. For all the questions regarding exercises, a significantly higher number of crew members and workstation operators, vice the unit leaders, indicated revisions were needed. This may be due to the nature of training at the collective task level. The primary revision effort focused on increasing the level of difficulty by putting additional OPFOR pressure on the units. A

list of several revisions is located after this section. Also, there were several notes (not included in this report) to fix minor errors such as altering air routes or locations of elements which were not identified during internal testing.

Table 17

Unit Survey Responses on Need for Revisions to Table

Q: Does the table (scenario) need revision?	Tank platoon	Mech platoon	*Platoon (all)*	Tank team	Mech team	*Team (all)*	Tank units	Mech units	*Overall*
Yes	20%	37%	*28%*	24%	32%	*29%*	22%	35%	*29%*
No	71%	54%	*63%*	71%	57%	*62%*	71%	55%	*62%*
Not sure	9%	9%	*9%*	5%	11%	*9%*	7%	10%	*9%*

Table 18

Unit Survey Responses on Difficulty of Knowing When to Perform Tasks

Q: Was the table too easy or too hard in terms of knowing when to perform the tasks?	Tank platoon	Mech platoon	*Platoon (all)*	Tank team	Mech team	*Team (all)*	Tank units	Mech units	*Overall*
Too easy or easy	16%	18%	*17%*	6%	19%	*14%*	12%	18%	*16%*
About right	82%	78%	*81%*	91%	79%	*84%*	86%	79%	*82%*
Hard or too hard	2%	4%	*2%*	3%	2%	*2%*	2%	3%	*2%*

Table 19

Unit Survey Responses on Task Difficulty

Q: Was the table too easy or too hard in terms of performing the tasks?	Tank platoon	Mech platoon	*Platoon (all)*	Tank team	Mech team	*Team (all)*	Tank units	Mech units	*Overall*
Too easy or easy	20%	16%	*18%*	10%	19%	*16%*	15%	18%	*17%*
About right	75%	79%	*78%*	86%	77%	*80%*	80%	77%	*79%*
Hard or too hard	5%	4%	*4%*	4%	4%	*4%*	5%	4%	*4%*

Tables 20 and 21 provide data regarding the amount and realism of the message traffic during an exercise. The responses are very favorable, yet numerous comments documented by the observers, noted on the surveys, and provided during interviews, indicated the amount and realism of the message traffic could be improved. This was particularly true with regard to the

higher headquarters message traffic. There were no indications, however, as to how that would be accomplished. That could be an issue of focus in future development efforts. It was interesting that even those respondents marking the "about right" or "marginally realistic" choices often wrote a comment indicating an increase in the amount and realism of messages was desired.

Table 20

Unit Survey Responses on Amount of Message Traffic

Q: Was there the right amount of message traffic?	Tank platoon	Mech platoon	*Platoon (all)*	Tank team	Mech team	*Team (all)*	Tank units	Mech units	*Overall*
Too little	14%	15%	*15%*	16%	15%	*15%*	15%	15%	*15%*
About right	85%	84%	*84%*	80%	83%	*82%*	83%	83%	*83%*
Too much	1%	1%	*1%*	4%	2%	*3%*	2%	2%	*2%*

Table 21

Unit Survey Responses on Realism of Message Traffic

Q: Was the message traffic realistic?	Tank platoon	Mech platoon	*Platoon (all)*	Tank team	Mech team	Team (all)	Tank units	Mech units	*Overall*
Not realistic	31%	25%	*20%*	28%	41%	27%	35%	21%	*27%*
Marginally realistic	62%	68%	*72%*	65%	55%	67%	59%	70%	*66%*
Very realistic	7%	7%	*8%*	7%	4%	6%	6%	8%	*7%*

Finally, the units were asked a series of questions regarding the need to revise the AAR activities which included the task review, scenario analysis, unit discussion, and performance assessment. Though the survey data (Table 22) indicate general support for the activities, a sizable number (25%) felt it could be revised. Also, the observers noted that not all the units followed the format as designed, omitting the task review and unit discussion. Survey responses indicated the least preferred activity was the performance assessment. More study of the AAR process could provide guidance in improving this activity by identifying why some steps are considered not important.

Table 22

Unit Survey Responses on Revisions Needed to the AAR Activities

Q: Do the post-exercise activities need revision?	Tank platoon	Mech platoon	*Platoon (all)*	Tank team	Mech team	Team (all)	Tank units	Mech units	*Overall*
A lot, some, or a little	18%	34%	*25%*	26%	24%	25%	22%	29%	*25%*
No	68%	54%	*62%*	68%	43%	52%	68%	47%	*57%*
Not sure	12%	8%	*10%*	5%	10%	8%	9%	9%	*9%*
No response	2%	4%	*3%*	1%	23%	15%	1%	15%	*9%*

Table Modifications

The STRUCCTT team made changes to the tables based on comments from the participating units and observers. Table 23 and Table 24 detail the general and specific changes made, respectively. The changes made ensured the exercises were sufficiently challenging to units as they became more familiar with CCTT. They also provided for increased opportunities for units to execute specified task performance and to adjust for emerging OPFOR doctrinal capabilities. It is important to remember that there was no opportunity to test the acceptability of these modifications.

Table 23

General STRUCCTT Table Changes

Category	Change	Rationale
OPFOR	Competency increased from "NOVICE" to "COMPETENT"	Strengthens enemy forces
	Engagement range for ground forces increased to 3000m	Strengthens enemy forces, within weapon systems effective ranges and tactical use
Environment	Night Mission tables reset from "FULL MOON" to "HALF MOON"	Increases table difficulty
Countermobility	BLUFOR minefield density decreased from 1 mine per meter to 3 mines per 10 meters.	Increases table difficulty, allowing some enemy forces to penetrate the minefields

Table 24

Specific STRUCCTT Table Changes

Table(s)	Change	Rationale
PMD1D	OPFOR air overflight retimed to occur after fuel/ammo resupply	Resupply vehicles would scatter automatically when overflight occurred
PMD3D	OPFOR deployment line increased to 4700m	Provides OPFOR more time to get into battle formation, increasing table difficulty
	OPFOR antitank guided missile platoon added	Increases table difficulty
PMF3D	Entire table moved to same location as PAF3D	Realigns TSP structure and provides better location performing tasks
	OPFOR helicopters added	Replicates insertion of dismounted infantry, providing BLUFOR dismounted infantry activity and increasing table difficulty
	OPFOR mechanized infantry platoon added	Provides BLUFOR dismounted infantry activity, increasing table difficulty
PMM2D	Route of OPFOR helicopters changed	Provides increased opportunity for contact with manned modules
PMM3D	The task "Assault Mounted" deleted	Task could not be performed and stay within the tactical scenario
TMF1D	Armored vehicle launched bridge and anti-tank ditch deleted	Not needed/required for the tactical scenario
TMF2D & TMF3D	OPFOR air competency increased from "NOVICE" to "COMPETENT"	Strengthens enemy forces, allowing them to fire at friendly forces (as provided by weapon systems effective ranges and tactical use)
	OPFOR air engagement range decreased to 2000m from 3000m	BLUFOR could not see/identify OPFOR at 3000m (previous setting); provides BLUFOR the opportunity to defend themselves
TMF3D	Combat trains command post vehicles deleted	Vehicles not needed in the table
	OPFOR combat reconnaissance patrol added	Increases table difficulty
	Modified OPFOR forward support element and advanced guard main body routes	Provide more tactically realistic course of action for the OPFOR
	Added/adjusted target reference points	Provide BLUFOR more robust operational graphics set, better sited to engage OPFOR

LUT Formative Evaluation Summary

Overall, the formative evaluation supported the STRUCCTT TSP design. However, several issues surfaced for consideration in future development efforts. The first concerns the issue of ensuring the training provides an opportunity to increase unit task proficiency. This may be accomplished by placing emphasis on task review during the preview and providing additional troop leading time. The observers noted, in several instances, that the reviews of the tactical situation received the most attention during the exercise preview. Often the tasks were not discussed, nor were the task charts displayed. The second issue is to ensure the exercises provide the explicit cues needed to prompt task execution. One way to accomplish this would be to ensure there is sufficient and appropriate message traffic for the scenario. Particularly noted by the observers and participants was the lack of appropriate messages from higher headquarters painting a complete picture of the developing situation. Finally, it is important to develop a unit performance assessment process that is positively supported by the participants. The survey responses indicated performance assessment ranked last in the post-exercise activities. More study may determine what can be done within CCTT to foster appreciation of objective performance assessment.

There was some additional statistical analysis conducted of the survey responses which produced two interesting items for future consideration. Though it is not surprising, there was substantial evidence that units do not react uniformly to the STRUCCTT tables. Particularly interesting was the observation that the armor platoon cross-attached to a mechanized infantry company (or the mechanized infantry platoon cross-attached to an armor company) gave very different responses than the platoons that were of the same branch as their company team headquarters. Mechanized infantry units were almost twice as likely to indicate that the table scenario needed revision than did tank platoons. While the difference was not as great at the company team level, almost a third of the mechanized infantry team members surveyed thought table scenarios needed to be revised while only a fourth of the tank team members held the same view. More study is required to determine whether this phenomenon is repeatable, and, if it is, to develop an explanation for it. Also, perhaps the most interesting finding is the strong difference between the armor and mechanized infantry company teams with respect to the content of the tables. Personnel in the armor company teams were much more likely to report that the tables contained all the appropriate tasks, did not contain inappropriate tasks, and were complete sets of events and tasks. A more probing analysis of the tasks that mechanized infantry personnel feel are missing, or inappropriate, is needed to determine whether the tables for mechanized infantry company teams can be improved for use in the CCTT system.

Battalion TF Exercise Evaluation

After completion of the LUT, the STRUCCTT team conducted a trial of the battalion TF training exercise. The battalion TF training exercise was designed as a multi-day training experience, beginning with basic familiarization training and culminating with a battalion TF-level exercise a few days later (shown in Table 25). Training prior to the battalion TF exercise included crew familiarization training, coordination and training between platoon leaders and dedicated SAF operators, staff training, and specific training for units with SAF elements. This training

differed from the projected train-up because the unit was notified late and most of the unit personnel were on block leave until the day prior to the battalion TF exercise execution. As a result, there was little off-site preparation or training.

Table 25

Battalion TF Exercise Schedule

Day	Activities
1 (Train Up)	CCTT familiarization; workstation training; main command post (CP) setup; battalion TF backbrief; initial reconnaissance
2 (Rehearsal)	Battalion TF rehearsals; company team CFS practice; final reconnaissance
3 (Execution)	Battalion TF exercise execution(s) and AAR

STRUCCTT team members had a limited opportunity for formative evaluation during the Battalion TF Exercise. As noted earlier, the TF received the mission to become the trial unit about three weeks prior to the exercise. The STRUCCTT team was able to brief the Senior O/C and the TF commander on the design of the exercise and the scope of the trial unit's participation and provide them with pre-exercise materials. TF personnel were then released for a two week leave period. The STRUCCTT Team was subsequently told by the TF Commander that his staff and subordinate commanders had not had an opportunity to become familiar with all of the pre-exercise materials that had been given to them. The Senior O/C, likewise, had been precluded by other duties from becoming thoroughly familiar with all of his pre-exercise materials. Additionally, his higher headquarters was unable to provide him the personnel to fill the STRUCCTT Team's recommendation for the number of controllers and observer/controllers. Out of the total recommendation for 13 observer/controllers, only five were available. As a consequence, the company team O/C and higher headquarters controller positions were not covered, and STRUCCTT Team members assumed the duties of Exercise Controller and OPFOR Controller. As a result, little additional information about the utility of the pre-exercise and exercise materials was obtained from either the unit or from the O/C team.

The STRUCCTT Team was able to conduct extensive observations of the TF staff executing the mission as well as the interaction between the Senior O/C and the TF leadership. Another valuable resource for the STRUCCTT Team's formative evaluation was the trial unit's Assistant Division Commander for Maneuver who was an active participant in the exercise. An after exercise group interview ("hotwash") was conducted with key personnel from the Task Force where overall comments about the exercise were obtained. An AAR was also held where some additional comments about the exercise design and materials were developed, but participation by the Corps Commander and other general officers limited the discussion. Interviews were conducted with four of the controllers who provided substantive comments about the exercise tactical materials and controller material. Surveys were prepared for the participants. However, the STRUCCTT Team was unable to administer them due to the scheduling of the AAR on the day following completion of the trial, unexpected participation by general officers, and the need for the unit leadership to depart immediately after the AAR for another training

exercise away from Fort Hood. Table 26 provides the revisions made implemented to the TF exercise as a result of the observations and interviews.

Table 26

Revisions to the Battalion Task Force Table

Revision
Additions to the TSP:
repair guidelines
element replacement guidelines
instructions for artillery movement, keys from the task force movement
instructions for OPFOR controller to pass enemy situation updates to Higher Headquarters (HHQ) Intelligence (Intel)
task list on the observation forms
air temperature and barometric pressure updates at the start of the exercise
changed the times in the event guide to H+ times instead of real time
intel update at the start of the exercise
simple picture of the enemy scheme of maneuver in the O/C workbook
Changes to the exercise:
increased staffing for the HHQ to include OPS, INTEL, and CSS
started artillery further back and had their first action as a move to a position area for artillery (PAA)
made the combat reconnaissance patrol (CRP) initial movement in the southern portion of the corridor
relocated the combat trains with the companies

Lessons Learned

An important part of developmental projects of this nature is the documentation and discussion of the lessons learned. Lessons learned serve two purposes: they identify the processes that worked and those which did not during the conduct of the project, and they provide guidance for future projects and for the improvement of the products of similar developmental efforts. Experience in this project provides insights into the use of CCTT as a training system and into the development of structured training exercises for simulators or simulations while they are still under development.

The audiences for the lessons learned include: (a) simulation system developers (hardware and software) and integrators, (b) training program designers and developers, (c) trainers at CCTT Sites and units who must maintain the program and recommend improvements to it, and (d) any member of the U.S. Army who desires to understand the process by which products of this type are created.

The discussion of lessons learned in this section is organized into three topics:

- Support of Emerging Systems
- Distinctive Features of the Training Approach
- Framework for Implementing Tables

Support of Emerging Systems

One of the key decisions for this project was made before the SOW was issued. It concerned whether training development should be conducted concurrently with the CCTT development or be postponed until the CCTT was stable. The decision was to develop training concurrently with the CCTT development. That was the correct decision for three reasons. First, concurrent development shortened the time for incorporating the CCTT into unit training programs. Second, it enabled meaningful demonstrations of CCTT capabilities. Third, the concurrent development approach gave system developers potentially valuable feedback on system capability for tactical purposes (e.g., early evidence that the overlay system needed to accept many more checkpoints than had been planned). Achieving those benefits imposed costs for integrating efforts and accommodating the inevitable false starts. Those costs and recommendations for dealing with them are discussed in the following section.

Development of Exercises for Emerging Systems Requires Formal Integration

Problem. Because CCTT was an emerging system, hardware and software changed frequently. Unfortunately, the modifications and improvements made by software developers and programmers sometimes rendered already completed exercises obsolete. For example, the ongoing software modifications invalidated most of the OPFOR combat instruction sets (CIS), creating a need to rebuild and test the CIS before the exercises could be used properly. In addition, changes were frequently not documented for users. The CCTT Site staff and the

STRUCCTT Team had to "learn by discovery" the effects of the changes on the CCTT system and on the exercises.

Recommendation. Formal channels should be established so that software developers and programmers can coordinate with training developers and system operators before implementing changes to determine the impact of the changes and, perhaps, to identify alternative modifications. After the least disruptive solution has been identified, programmers should develop procedures to assure that the system is backward compatible (i.e., exercises developed under the previous configuration will operate with minimal revision in the improved environment). If backward compatibility is not practical, the changes should, at least, be documented. Updates on the operation of the software and the overall system need to be controlled by an individual point of contact.

Training developers also have an obligation to be prepared to take maximum advantage of coordination opportunities. For example, early in the development process, the STRUCCTT Team traveled to the STRICOM CCTT test facility to receive hands-on training on the system and to begin the initial exercise building. Unfortunately, the team had not yet laid out some of the specific locations, force sizes, and graphics needed to create basic draft electronic files. In later trips to the CCTT Sites at Orlando and at Fort Hood, the team was ready for the system when access was granted, and had paperwork and graphics to support full exercise creation.

Development of Exercises for Emerging Systems Requires Informal Coordination

Problem. In addition to major changes that should be coordinated and documented formally, there will inevitably be modifications that do not appear to warrant documentation but still have an impact on development.

Recommendation. Implement informal channels of coordination among developers in lead agencies as was done throughout the STRUCCTT Project. Those agencies included the CCTT Sites at Fort Hood and Fort Knox, TSM-CATT, ARI, and STRICOM. The informal arrangements with these agencies were necessary to keep the flow of information open and quickly meet any small requirements that arose. For example, calls to the Fort Hood Site on questions of system functionality routinely were met with clear, concise answers. A key to that arrangement was the matching of STRUCCTT Team talent with their appropriate counterparts in those agencies. Without such an arrangement, even small development problems can become difficult obstacles.

Training Materials Should Be Evaluated Prior to User Tests

Problem. The formative evaluation process for tables such as those in STRUCCTT would normally include an internal (among developers) cycle of tryout-revise-retest followed by a similar cycle using unit personnel. The internal evaluation confirms that the events do occur within the simulation; the user evaluation checks whether the conditions established are sufficient to elicit the desired tasks and lead to meaningful training given the status of the unit. This project, however, was designed so that the user evaluation of the platoon and company team tables would be

conducted in the context of the user test (initially, the IOT&E; ultimately, the LUT). This approach reduced the value of the STRUCCTT evaluation during the unit trial. Because TEXCOM understandably required standardized conditions throughout the LUT, the STRUCCTT Team was not allowed to revise and retest the tables and supporting TSPs. The approach involved two risks. First, the tables might have been unsuitable for the units in the LUT. Fortunately, units perceived the training as meaningful. Second, the effectiveness of revisions based on the LUT results is unknown, since the project ended before the revised tables could be reevaluated during unit training.

Recommendation. The formative evaluation of tables and supporting materials should be conducted with representative units before the start of comprehensive evaluations such as an IOT&E or LUT.

OPORD Approval Process Needs a Validating Authority

Problem. As part of the formative evaluation, OPORDs were submitted to proponent agencies early in the development process. Rather than examine the OPORDs for tactical sufficiency and doctrinal correctness (IAW FM 71-1, [DA, 1988c], FM 71-2 [DA, 1988b], and FM 101-5 [DA, 1997]), reviewers tended to provide their "this is how I would fight this battle" perspective. Because of the nature of simulation and the need to achieve training benefits, not all possible tactical solutions can be supported. The role of the developer is to examine the possibilities and select the one that best supports the execution of the tasks identified for the mission. OPORD review must focus on issues of format, executability, correct application of tactical doctrine, and training benefits, not on the personal views of the reviewer.

Recommendation. A formal OPORD-approval process must be in place, headed by a person who has doctrinal status to coordinate between developers and reviewers. The STRUCCTT Team was fortunate in that the TSM provided an "honest broker" function in this matter. Without him in that role, it would have been extremely difficult to reach compromises across the disparate recommendations that were received.

Distinctive Features of the Training Approach

Experience in this project suggests several lessons about providing information to users of STRUCCTT TSPs. These lessons are discussed in the following section.

Clarifying Distinctive Features of the Training Approach

Problem. The training approach in STRUCCTT differs in three important respects from training events typically conducted in field exercises or at Combat Training Centers. These differences focus on execution, accomplishing tasks, and the commander's assessment. The first difference is that STRUCCTT focuses on the execution phase rather than planning. There is also a practical rationale--simulation systems, especially emerging systems, are necessarily limited in the number of tactical options they can accommodate. One result of the execution emphasis is that the OPORDs must be prepared long before a specific unit schedules training and changes to

the OPORDs must be carefully controlled. The second distinctive characteristic of training such as STRUCCTT is that it focuses on accomplishing tasks and task steps to standard rather than on the outcome of an engagement. This focus enables units to establish procedures and develop proficiencies that enable them to take full advantage of subsequent free-play simulations or field-training exercises. It also restricts the changes that can be made to the scenario because the evaluation tools prepared for the O/C's use are derived from the tasks and conditions previously established in the exercise design. The third characteristic is that the training is geared to the commander's assessment of the individual and collective tactical proficiency of the unit rather than an external assessment of his unit. The commander determines the mission selection and sequencing of the exercise(s) to meet his unit's needs. If the unit starts at a relatively low level of training, external observers not familiar with the structured training design may conclude that the training scenario is not sufficiently challenging. However as units become task proficient, CCTT provides a wide range of opportunities to modify existing structured exercises or to develop entirely new exercises that can provide increased challenges for units. If these features are not communicated and understood by unit leadership, the effectiveness of this training approach is severely restricted.

Recommendation. A program or tool needs to be developed which provides this type of information to the prospective CCTT user in order to acclimate them to the training approach. With a clear understanding of this type of training the units can more effectively use the simulation time to practice execution, focus on task proficiency which is transferable to multiple situations, and tailor the training focus to meet the unique needs of their unit.

Distinctive Features of STRUCCTT Exercises Must Be Clarified for O/Cs

Problem. Preparation of O/Cs is crucial in all simulation-based training. It is even more important for an implementation like STRUCCTT where O/Cs are drawn from sister or higher units (rather than drawing on a dedicated cadre of O/Cs). Unit Commanders need to insure that tactically proficient and technically competent soldiers are selected to be O/Cs. Even though materials on O/C responsibilities were made available, observation of O/C activities during the LUT suggested that they had not fully understood the distinctive features of STRUCCTT (e.g., adding indirect fire when units stopped to reorganize) and often did not use the AAR materials.

Recommendation. Increase the emphasis on the need for O/C training and preparation. Increased emphasis should be given to the need to attend to doctrinal task performance, not outcomes, and to avoid changes to "improve" the scenario that alter or eliminate cues for task performance.

Units Must Be Oriented to Distinctive Features of STRUCCTT Exercises and Have Implemented the Train-up Strategy Prior to the Training Event

Problem. The units that participated in the LUT were not identified until just prior to the test. Consequently, these units had only limited time to study the pre-exercise materials and to prepare for participation in the test. Even those units who participated in the battalion TF exercise did not devote any time to train-up activities that would prepare subordinate units for the

battalion TF mission (the exercise was preceded by block leave). The lack of preparation experienced in the external formative evaluation is not inherent in STRUCCTT, "real-world" units would almost certainly have a greater sense of commitment (if not, they would probably cancel the training). But the low level of preparation experienced here does illustrate the importance of train-up activities and suggests the need for emphasis. The absence of train-up for subordinate units was found to reduce the amount of time units spend in the simulation. Further, low familiarity with distinctive features of STRUCCTT reduced acceptance of the OPORD and delayed immersion in the training environment.

Recommendation. The demonstrations should be implemented in professional development sessions before the units report to the CCTT Site. Those sessions should be conducted far enough in advance for officers and NCOs to orient and train subordinates on task prerequisites.

Understanding the OPORD in Simulation Training

Problem. Greater emphasis should be placed on explaining to company team commanders, and to battalion TF commanders and staffs the rationale for the OPORD. Resistance to the OPORD has been a persistent problem with simulation training focused on the execution phase (Hoffman et al., 1995). The reluctance to execute a school-approved OPORD reflects, in part, the Army-wide emphasis on decentralized command decision making. In addition, the school-approved OPORDs are very thorough. Units that have streamlined the OPORD format seem to resist the level of detail included.

Recommendation. Dealing with the reluctance to "own" the OPORD requires a straight-forward explanation of the link between the OPORD and the execution of specific tasks at prescribed times that are necessary to drive the training of other tasks. Once that context is established, however, coordinators who are expert in the nuances of the scenario should work with the commanders and staff to adjust the tables to accommodate unit needs (in so far that the commanders and staff feel this to be necessary and the thrust of the table can be preserved).

Framework for Implementing Tables

Even though the user tests were the driving factors in the STRUCCTT project, the tables and TSPs were developed within the framework of a full set of tables and exercises that can be integrated into unit training. Related to this, three lessons are suggested: (1) a reassessment of the crawl-walk-run levels for future tables, (2) the establishment of a structure for managing the full scope of structured training in the CCTT, and (3) a process for maximizing the capabilities of CCTT should be explored.

Impact of Visibility Factors on Crawl-Walk-Run Levels Should Be Reassessed

Problem. The STRUCCTT system keys off a commander's assessment of unit proficiency. The commander is guided to an initial table that will challenge the unit yet is within the unit's capabilities. The unit then progresses through increasingly complex tables. During the

design phase, visibility conditions (day, fog, night) were expected to be one set of factors affecting complexity. In practice, however, fog conditions tended to make execution easier and the night exercises did not have as much impact on difficulty as anticipated, largely because the night capabilities given within CCTT to friendly forces are far superior to those given to the OPFOR.

Recommendation. Because the representation of these environmental conditions is one of the requirements for CCTT, the tables must provide effective training under fog and night conditions. If the current OPFOR capabilities replicate the enemy, that goal is being met with the current tables. In that case, the recommendation is that the effects of night and fog be explained more clearly to units and future training developers. If the effects are not accurate representations of enemy capabilities, OPFOR night and fog actions should be redefined. In either case, the impact of environmental factors should be periodically revisited to be sure that any new increases in enemy capabilities are represented in the STRUCCTT scenarios.

Sustainment Management is Needed to Ensure that the Training System Survives Beyond the End of the Project

Problem. Currently, there is no system in place to attend to the long term care and management of structured training within the CCTT training system. Within weeks of delivery of the final TSP and associated electronic files, software and hardware upgrades changed the way in which the system operated. While Fort Hood CCTT personnel are working to revise the electronic files so that the exercises will run, no one is tasked or positioned to correct the already delivered paper TSPs. In a related area, changes to tactics and doctrine occur at a rapid pace. Emerging doctrine will cause the exercises to become dated from both an OPFOR perspective (as enemy tactics evolve and their expected actions and reactions change) and a BLUFOR perspective (as doctrine changes and field manuals, ARTEPs, and other doctrinal materials are revised). Without a mechanism to make the changes necessary to keep the system current, the tables will eventually become less tactically useful.

Recommendation. A site-based quality management consortium should be established to handle issues of a local nature (e.g., unit SOPs) and higher level tactics, techniques, and procedures (Bessemer & Myers, 1998). Additionally, a more deliberate cooperative effort is needed between the PM-CATT (hardware/software) and the TSM-CATT (doctrine) offices to handle issues of emerging doctrine and the most effective way to recommend changes to the CCTT system.

Maximizing Capabilities of CCTT

Problem. To maximize the effectiveness of its use, CCTT must be fielded as a complete, integrated training system. There are many inter-related parts to such a system, including users (units and soldiers), software, hardware, and various tools to enable users to exploit the capabilities of the software and hardware. Users especially need an efficient way to learn about the full capabilities of CCTT and how to effectively use them to support their training. Several tools which can help the users in this regard are currently under development. As these tools

become available, users need to be able to learn about them and integrate them into their CCTT training strategy without physically coming to the site and competing with other users for access to the hardware and software in order to learn how to operate the system or to plan exercises.

Recommendation. An integrating system or tool should be developed to provide trainers with a ready access to all the information and methods they need to exploit the emerging capabilities of CCTT. It should serve as a gateway linking trainers to information sources through a stand-alone personal computer as well as through distributed (World Wide Web) access via standard web browsers. It should also be designed and developed to be compatible with and link to Army training management information systems and databases such as the Automated Systems Approach to Training (ASAT), the Standard Army Training System (SATS), TREDS, and the Army Training Digital Library (ATDL). This system or tool should lead users to effective and efficient methods for developing and implementing training in CCTT. Such a system, the Commander's Integrated Training Tool (CITT) is currently being designed in research project under contract to the U.S. Army Research Institute (ARI).

Conclusions

Project Summary

The work in this project was guided by the objectives: (a) development of complete exercises and TSPs to support the user test of the CCTT, (b) formative evaluation of the exercises and TSPs, and (c) documentation of lessons learned. The first and third of these objectives were met; the second was only partially accomplished.

Development and Lessons Learned in Support of User Test of CCTT

Although faced with the difficult task of developing a large number of training exercises for a complex simulation system that was itself still in development and undergoing constant hardware and software changes, the STRUCCTT project was able to produce exercises and supporting materials that satisfied military and civilian observers, and that units participating in CCTT trials considered worthwhile. The lessons learned indicate that close and informal working relationships between the STRUCCTT Team and other personnel involved in CCTT development were key to this success.

Some of the lessons learned indicate that there are requirements for maintaining the library of TSPs and exercises developed in this project as the basis for an expanded library of exercises. The CCTT system is still evolving to its eventual configuration, and the doctrine of the U.S. Army is undergoing review and revision. Both of these factors will influence the future relevance and utility of the exercises developed by the STRUCCTT Team.

These lessons learned have broad application to the development of future training systems. To the extent that the Army wishes to provide libraries of training exercises aimed at critical tasks, investments will have to be made in educating leaders and trainers in the value of

structured training approaches and to maintain the libraries of exercises and related training materials.

Formative Evaluation

The requirement to conduct the external formative evaluation of platoon and company team tables in the context of the LUT of CCTT resulted in only a partial evaluation of the STRUCCTT materials. The tables that were evaluated were judged effective and observation of performance led to some revisions of those tables. Still, only a subset of exercises were evaluated, and that evaluation was in a context that did not include a systematic train-up with a unit-focused strategy.

Even with the constraints, it was clear from observation that units using structured training will need a better introduction to the value of this approach and training in how to integrate it into their training programs. They will need guidance about how to prepare for their use of the CCTT in structured (and other types of) training exercises.

Future Directions

The highest priority ought to be given to completing the library of platoon and company team tables and adding battalion TF exercises on defense and attack. Because the current tables tend to be toward the crawl or basic end of the complexity continuum, they probably do not represent the full capability of the CCTT; the additional tables should include one of greater complexity and difficulty.

Once a full set of tables and exercises is developed, the program ought to be assessed in the context of a unit training cycle. The selection of tables and progress to the battalion TF exercises should be guided by the commander's assessment of unit strengths and weaknesses. If the necessary hardware capability is added, the train-up for the tables should include the demonstrations. The conduct of the training should focus on tasks and maintain the integrity of the scenarios.

There are two areas, which were discussed earlier in the LUT Formative Evaluation Summary, which need further research. The first area is to study how the CCTT can be used to foster the development of a more objective and realistic approach to performance assessment. The second area would be the development of a training strategy using CCTT structured exercises that could deal with a possible difference in the perception of the validity of these type of exercises between tank and mechanized infantry units.

As resources for training in units become scarcer and scarcer, every avenue which provides effective training for less cost should be pursued. The authors believe that structured training in simulation can provide a way to stretch training resources effectively. They believe the investment in building and maintaining libraries of structured training exercises is fully justified.

References

Bessemer, D. W. & Myers, W. E. (1998). Sustaining and improving structured simulator-based training (ARI Research Report 1722). Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences.

Burnside, B. L. (1990). Assessing the capabilities of training simulations: A method and Simulation Networking (SIMNET) application (ARI Research Report 1565). Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences.

Burnside, B. L., Leppert, M. A., & Myers W. E. (1996). Virtual training program orientation guide (ARI Research Product 97-02). Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences.

Campbell, C. H., Campbell, R. C., Sanders, J.J., Flynn, M. R., & Myers, W. E. (1995). Methodology for the development of structured simulation-based training (ARI Research Product 95-08). Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences.

Campbell, C. H., Deter, D. E., & Quinkert, K. A. (1997). Report on the expanded methodology for development of structured simulation-based training programs (ARI Research Report 1710). Alexandria, VA: U. S. Army Research Institute for the Behavioral and Social Sciences.

Department of the Army (1988a). Training the force (FM 25-100). Washington, D. C.

Department of the Army (1988b). Tank and mechanized infantry battalion task force (FM 71-2). Washington, D.C.

Department of the Army (1988c). Tank and mechanized infantry company team (FM 71-1). Washington, D.C.

Department of the Army (1994). Heavy opposing force (OPFOR) tactical handbook (TRADOC Pamphlet 350-16). Fort Monroe, VA.

Department of the Army (1995). Training development management, processes, and products (TRADOC Regulation 350-70). Fort Monroe, VA.

Department of the Army (1996). Tank platoon (FM 17-15). Washington, D.C.

Department of the Army (1997). Staff organization and operations (FM 101-5). Washington, D.C.

Graves, C. R., & Myers, W. E. (1996). An expansion of the virtual training program: History and lessons learned (ARI Research Report 1703). Alexandra, VA: Army Research Institute for the Behavioral and Social Sciences.

Hoffman, R. E., Graves, C. R., Koger, M. E., Flynn, M. R., & Sever, R. S. (1995). Developing the reserve component virtual training program: History and lessons learned (ARI Research Report 1675). Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences.

Kemp, J. E. (1985). The instructional design process. New York: Harper & Row.

Sherikon (1996). Task performance support (TPS) codes for CCTT (Volumes III - VII). Orlando, FL: Author.

Shlechter, T. M., Bessemer, D. W., Nesselroade, Jr., K. P., & Anthony, J. (1995). An initial evaluation of a simulation-based training program for army national guard units (ARI Research Report 1679). Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences.

STRUCCTT Team (HumRRO, Hughes Training Inc., BDM Federal, & PRC Inc.) (1996). Execution plan for structured training for units in the close combat tactical trainer. Alexandria, VA: Human Resources Research Organization.

U.S. Army Research Institute (1996). Structured training for units in the close combat tactical trainer (Statement of Work). Fort Knox, KY: U.S. Army Research Institute for Behavioral and Social Sciences, Armored Forces Research Unit. (Available from U.S. Army Research Institute, Armored Forces Research Unit, ATTN: TAPC-ARI-IK, Fort Knox, KY 40121).

Appendix A

Acronyms

AAR	After Action Review
AFRU	Armored Forces Research Unit
ARI	Army Research Institute
ARTEP	Army Training and Evaluation Plan
ASAT	Automated Systems Approach to Training
ATDL	Army Training Digital Library
ATGM	Anti-tank Guided Missile
ATK	Attack
BFV	Bradley Fighting Vehicle
BLUFOR	Blue Forces
BMP	(Bronevaya Maschina Peikhota) Russian Infantry Fighting Vehicle
CATT	Combined Arms Tactical Trainer
CBI	Computer-Based Instruction
CCTT	Close Combat Tactical Trainer
CD-ROM	Compact Disc-Read Only Memory
CES	Combat Engineering Support
CFS	Command From Simulator
CFX	Command Field Exercise
CIS	Combat Instruction Set
CITT	Commander's Integrated Training Tool
CLS	Contractor Logistic Support
COBRAS	Combined Arms Operations at Brigade Level Realistically Achieved Through Simulation
COR	Contracting Officer's Representative
CP	Command Post
CRP	Combat Reconnaissance Patrol
CS	Combat Support
CSS	Combat Service Support
CTCP	Combat Trains Command Post

DA	Department of the Army
DATK	Deliberate Attack
DI	Dismounted Infantry
DIS	Defend in Sector
EDUCCATT	Education of CCTT through Computer Assisted Training Technology
FABTOC	Field Artillery Battalion Tactical Operations Center
FDC	Fire Direction Center
FIST-V	Fire Support Team Vehicle
FM	Field Manual
FS	Fire Support
FSE	Fire Support Element
FSO	Fire Support Officer
GCM	Graphic Control Measures
HELO	Helicopter
HHQ	Higher Headquarters
HMMWV	High Mobility Multi-Purpose Wheeled Vehicle
HUMRRO	Human Resources Research Organization
INTEL	Intelligence
IOT&E	Initial Operational Testing and Evaluation
IPR	In Progress Review
ISD	Instructional System Design
IVIS	Intervehicular Information System
LMTEF	Lockheed-Martin Test Facility
LUT	Limited User Test
MC	Maintenance Console
MCC	Master Control Console
METL	Mission Essential Task List
MTC	Movement To Contact
MTP	Mission Training Plan

NTC	National Training Center
OC	Operations Center
O/C	Observer/Controller
OPFOR	Opposing Forces
OPORD	Operations Order
OPS	Operations
PAA	Position Area for Artillery
PL	Phase Line
PM	Program Manager
PM CATT	Project Manager for the Close Combat Tactical Trainer
PVD	Plan View Display
SAF	Semi-Automated Forces
SATS	Standard Army Training System
SIMNET	Simulation Networking
SIMUTA	Simulation-Based Training for Multiechelon Training Program for Armor Units
SIMUTA-B	Simulation-Based Training for Multiechelon Training Program for Armor Units-Battalion
SME	Subject Matter Expert
SOP	Standing Operating Procedure
SOW	Statement of Work
STRICOM	Simulation Training and Instrumentation Command
STRONGARM	Strategies for Training and Assessing Armor Commanders' Performance With Devices and Simulations
STRUCCTT	Structured Training for Units in the Close Combat Tactical Trainer
TACP	Tactical Air Control Party
TEXCOM	Test and Experimentation Command
TF	Task Force
TFAM	Task Force Movement to Contact
TLP	Troop Leading Procedures
TPSC	Task Performance Support Codes

TRADOC	Training and Doctrine Command
TREDS	Training Exercise Development System
TSM	TRADOC System Manager
TSP	Training Support Package
UMCP	Unit Maintenance Collection Point
VCR	Video Cassette Recorder
VHS	Video High-Fidelity System
VTP	Virtual Training Program
WPE	Workstation Practical Exercise

Appendix B

Survey Examples

Instrument # 4A: Unit Post-Exercise Survey **PIN:** ______________

Exercise Name (from O/C): ____________ Date/Time: ____________

Position during the exercise (type vehicle/crew position): ________/________

Pre-Exercise Activity

1. Prior to the start of the exercise the O/C briefed you on the tactical situation and what to expect during the exercise. Place a check (✓) in the block to indicate whether each part of this pre-exercise activity needs revision; for any activity that did not occur check the N/A block.

Does it need revision?

	A Lot, Some, A Little	Not Sure	No	N/A
Review of tactical situation	399	25	698	52
Review of tasks	379	26	703	55
Demonstration	326	32	657	128
Battle rehearsal/reconnaissance	433	19	634	71

2. After the table preview, you should have been given the opportunity to conduct troop leading procedures and prepare for the table.

Indicate (in minutes) how much time you were given:

________ minutes

Rate the amount of time provided:

[27] Too much time
[712] About the right amount of time
[403] Too little time
[70] N/A

Exercise Execution

3. During the exercise the unit performed a series of tasks within the context of a larger tactical mission. Place a check (✓) in the block to indicate whether the actions, tasks, and events which occurred need revision, whether the difficulty level and message traffic were set correctly, and whether the exercise was complete, as listed in the questions below:

Does it need revision?

	A Lot, Some, A Little	Not Sure	No
Sequence of events	382	170	731
Appropriate of the tasks	334	126	823
Matching of tasks to events	325	136	822

Level of Difficulty

	Too Easy, Easy	About right	Hard, Too Hard
Knowing when to perform the tasks	214	1018	51
Performing the tasks	228	966	89

Message traffic: Amount received...

	Too little	About right	Too much
...from higher headquarters	156	1064	63
...from adjacent units	273	952	58

Message traffic: Realism of message...

	Not realistic	Marginally or Very Realistic	Not Sure
...from higher headquarters	76	1002	205
...from adjacent units	129	942	212

Exercise completeness: The exercise...

	Strongly Agree or Moderately Agree	Neither Agree or Disagree	Moderately Disagree or Strongly Disagree
...included all appropriate tasks	872	313	98
...did *not* include inappropriate tasks	728	421	164
...represents a complete set of events and tasks	848	338	97

Post-Exercise Activity

4. Following the structured training exercises, each unit participates in Post Exercise activities, including an After Action Review (AAR). This AAR consists of a number of specific steps which lead the unit through a systematic self-evaluation of their performance. Rank order from 1 (most valuable) to 5 (least valuable) the value of each AAR step to your learning in this exercise. In addition, place a check (✓) in the block to indicate whether each part of this post-exercise activity needs revision; for any activity that did not occur check the N/A block.

Rank **Does it need revision?**

	Order (1 to 5)	A Lot, Some, A Little	Not Sure	No	N/A
Task Review	N/A	292	101	672	146
Scenario Analysis	N/A	284	111	667	145
Demonstration Review	N/A	271	126	647	169
Unit Discussion	N/A	283	106	683	147
Table Assessment (Sustain/Improve)	N/A	276	114	660	160

Overall Time Assessment

5. Each exercise has three distinct parts; before the exercise (Pre-Exercise Activity), during the exercise (Exercise Execution), and after the exercise (After Action Review). Place a check (✓) in the blocks to rate the time spent in each of these activities.

Amount of time spent

	Too little	About right	Too much	N/A
Pre-Exercise Activity	218	893	38	59
Exercise Execution	51	1035	53	60
After Action Review	44	938	133	76

Other Comments

6. Sometimes other thoughts or concerns in training are not addressed by the questions asked. In the space provided please indicate any other thoughts you have about this training. You are free to expand on previous responses or to discuss areas not already covered which you believe need comment. If you need additional space please use the back of this form.

Instrument # 4B: O/C Post-Exercise Survey **PIN:** ________________

Exercise Name (from Event Guide): ___________ Date/Time: ___________

Position during the exercise (type vehicle/crew position): _________/_________

Pre-Exercise Activity

1. Prior to the start of the exercise you were briefed the tactical situation and what to expect during the exercise. Place a check (✓) in the block to indicate whether each part of this pre-exercise activity needs revision; for any activity that did not occur check the N/A block.

Does it need revision?

	A Lot, Some, A Little	Not Sure	No	N/A
Review of tactical situation	35	0	26	1
Review of tasks	23	0	38	1
Demonstration	16	0	14	32
Battle rehearsal/reconnaissance	25	0	30	6

2. After the table preview, you should have been given the opportunity to conduct troop leading procedures and prepare for the table.

Indicate (in minutes) how much time you were given:

_________ minutes

Rate the amount of time provided:

[3] Too much time
[33] About the right amount of time
[24] Too little time

Exercise Execution

Note: Question 3 responses are rolled up into the 4A survey on Pages B-1-1 and B-1-2

3. During the exercise the unit performed a series of tasks within the context of a larger tactical mission. Place a check (✓) in the block to indicate whether the actions, tasks, and events which occurred need revision, whether the difficulty level and message traffic were set correctly, and whether the exercise was complete, as listed in the questions below:

Does it need revision?

	A Lot	Some	A Little	Not Sure	No
Sequence of events					
Appropriateness of the tasks					
Matching of tasks to events					

Level of Difficulty

	Too Easy	Easy	About right	Hard	Too Hard
Knowing when to perform the tasks					
Performing the tasks					

Message traffic: Amount received...

	A Lot	Some	A Little
...from higher headquarters			
...from adjacent units			

Message traffic: Realism of message...

	Not realistic	Marginally realistic	Very realistic
...from higher headquarters			
...from adjacent units			

Exercise completeness: The exercise...

	Strongly Agree	Moderately Agree	Neither Agree or Disagree	Moderately Disagree	Strongly Disagree
...included all appropriate tasks					
...did *not* include inappropriate tasks					
...represents a complete set of events and tasks					

4. During the exercise the primary control tool was the Event Guide. Place a check (✓) in the block to indicate whether each part of the Event Guide needs revision.

Does it need revision?

	A Lot, Some, A Little	Not Sure	No
Event & O/C Actions	31	2	28
Unit Action	30	2	29
SAF (BLUFOR/OPFOR) Action	29	3	28
Unit Support Workstation Actions	20	6	34
ARTEP Information	20	5	36
AAR Observations	23	5	28
Time/Comments	23	2	36
Overall structure of the guide	25	2	34

Post-Exercise Activity

5. Following the structured training exercises, each unit participates in Post Exercise activities, including an After Action Review (AAR). This AAR consists of a number of specific steps which lead the unit through a systematic self-evaluation of their performance. Rank order from 1 (most valuable) to 5 (least valuable) the value of each AAR step to facilitation of the AAR in this exercise. In addition, indicate whether it needs revision; check N/A for any activity not done.

	Rank Order (1 to 5)	Does it need revision? A Lot, Some, A Little	Not Sure	No	N/A
Task Review	N/A	17	2	40	3
Scenario Analysis	N/A	11	4	44	3
Demonstration Review	N/A	9	4	27	23
AAR Discussion	N/A	8	7	45	3
Table Assessment (Sustain/Improve)	N/A	15	6	34	6

Overall Time Assessment

6. Each exercise has three distinct parts; before the exercise (Pre-Exercise Activity), during the exercise (Exercise Execution), and after the exercise (After Action Review). Place a check (✓) in the blocks to rate the time spent by the unit in each of these activities.

Amount of time spent

	Too little	About right	Too much
Pre-Exercise Activity	21	38	0
Exercise Execution	2	55	3
After Action Review	3	55	1

Other Comments

7. Sometimes other thoughts or concerns in training are not addressed by the questions asked. In the space provided please indicate any other thoughts you have about this training. You are free to expand on previous responses or to discuss areas not already covered which you believe need comment. If you need additional space please use the back of this form.

Instrument # 4C: Unit Work Station Post-Exercise Survey **PIN:** ___________

Exercise Name (from Event Guide): ___________ Date/Time: ___________

Workstation name: ___________________

Pre-Exercise Activity

1. Prior to the start of the exercise you were provided the opportunity to attend pre-exercise activities. Place a check (✓) in the block to indicate the parts you attended and whether those parts of the pre-exercise activity needs revision; check N/A for any part that was missing:

	Part attended		Does it need revision?			
	Yes	No	A Lot, Some, A Little	Not Sure	No	N/A
Review of tactical situation			17	0	51	9
Review of tasks			20	0	50	8
Demonstration			18	2	37	19
Battle rehearsal/reconnaissance			21	3	32	21

2. You were given the opportunity to set up your workstation and review the specific workstation execution guidelines for the station to which you were assigned. Check whether any part of these workstation execution guidelines needs revision with a check (✓):

Does it need revision?

	A Lot, Some, A Little	Not Sure	No
Overview	22	0	51
Focus	19	2	53
Exercise Guidance	25	0	49
Location	19	1	54
Rules of Engagement	14	1	59

Indicate (in minutes) how much time you were given:

_________ minutes

Rate the amount of time provided:

[9] Too much time
[62] About the right amount of time
[4] Too little time

Exercise Execution

3. During the exercise you and the unit performed a series of tasks within the context of a larger tactical mission. Place a check (✓) in the block to indicate whether the actions, tasks, and events which occurred need revision, whether the difficulty level and message traffic are set correctly, and whether the exercise is complete, as listed in the questions below:

Does it need revision?

	A Lot, Some, A Little	Not Sure	No
Sequence of events	21	9	59
Appropriateness of the tasks	24	8	58
Matching of tasks to events	22	11	56

Level of Difficulty

	Too easy, Easy	About right	Hard, Too hard
Knowing when to perform the tasks	28	57	4
Performing the tasks	35	48	7

Message traffic: Amount received...

	Too little	About right	Too much
...from higher headquarters	30	55	4
...from adjacent units	26	60	3

Message traffic: Realism of message...

	Not realistic	Marginally or Very realistic	Not Sure
...from higher headquarters	17	59	13
...from adjacent units	12	62	14

Exercise completeness: The exercise...

	Strongly Agree or Moderately Agree	Neither Agree or Disagree	Moderately Disagree or Strongly Disagree
...included all appropriate tasks	49	20	20
...did *not* include inappropriate tasks	47	25	17
...represents a complete set of events and tasks	54	28	7

4. During the exercise the primary control tool was the Event Guide. Place a check (✓) in the block to indicate whether each part of the Event Guide needs revision.

Does it need revision?

	A Lot, Some, A Little	Not Sure	No
Event & O/C Actions	18	9	48
Unit Action	20	12	38
SAF (BLUFOR/OPFOR) Action	16	13	46
Unit Support Workstation Actions	24	8	37
ARTEP Information	15	10	44
AAR Observations	16	8	47
Time/Comments	17	6	47
Overall structure of the guide	17	6	52

Post-Exercise Activity

5. At the end of the exercises you were provided the opportunity to attend post-exercise activities, including an After Action Review (AAR). This AAR consists of a number of specific steps which lead the unit through a systematic self-evaluation of their performance. Place a check (✓) in the block to indicate the parts you attended and whether those parts of the post-exercise activity need revision; check N/A for any part not done.

	Part attended		Does it need revision?			
	Yes	No	A Lot, Some, A Little	Not Sure	No	N/A
Task Review	60	8	13	0	45	12
Scenario Analysis	58	8	15	0	43	12
Demonstration Review	55	11	12	2	42	14
Unit Discussion	61	8	18	1	42	9
Table Assessment (Sustain/Improve)	57	10	19	1	36	14

Other Comments

6. Sometimes other thoughts or concerns in training are not addressed by the questions asked. In the space provided please indicate any other thoughts you have about this training. You are free to expand on previous responses or to discuss areas not already covered which you believe need comment. If you need additional space please use the back of this form.

Instrument # 4D: CLS Workstation Post-Exercise Survey **PIN:** ____________

Exercise Name (from Event Guide): ____________ Date/Time: ____________

Workstation name: ____________________

Pre-Exercise Activity

1. Prior to the start of the exercise you were given the opportunity to set up your workstation and review the specific workstation execution guidelines for the station to which you were assigned. Place a check (✓) in the block to indicate whether any part of these workstation execution guidelines needs revision:

Does it need revision?

	A Lot, Some, A Little	Not Sure	No	N/A
Overview	3	5	56	4
Focus	2	6	56	4
Enemy Intent (OPFOR workstation only)	3	1	49	16
Exercise Guidance	3	3	58	4
Location	3	2	58	5
Rules of Engagement	2	1	60	5

Indicate (in minutes) how much time you were given:

_________ minutes

Rate the amount of time provided:

[1] Too much time
[30] About the right amount of time
[0] Too little time

Exercise Execution

Note: Question 2 responses are rolled up into the 4A Survey, Question 3, Pages B-1-1 and B-1-2

2. During the exercise you and the unit performed a series of tasks within the context of a larger tactical mission. Place a check (✓) in the block to indicate whether the actions, tasks, and events which occurred need revision, whether the difficulty level and message traffic are set correctly, and whether the exercise is complete, as listed in the questions below:

Does it need revision?

	A Lot	Some	A Little	Not Sure	No
Sequence of events					
Appropriateness of the tasks					
Matching of tasks to events					

Level of Difficulty

	Too Easy	Easy	About right	Hard	Too Hard
Knowing when to perform the tasks					
Performing the tasks					

Message traffic: Amount received...

	A Lot	Some	A Little
...from higher headquarters			
...from adjacent units			

Message traffic: Realism of message...

	Not realistic	Marginally realistic	Very realistic
...from higher headquarters			
...from adjacent units			

Exercise completeness: The exercise...

	Strongly Agree	Moderately Agree	Neither Agree or Disagree	Moderately Disagree	Strongly Disagree
...included all appropriate tasks					
...did *not* include inappropriate tasks					
...represents a complete set of events and tasks					

3. During the exercise the primary control tool was the Event Guide. Rate which parts of the Event Guide needs revision.

Does it need revision?

	A Lot, Some, A Little	Not Sure	No	N/A
Event & O/C Actions	4	8	50	6
Unit Action	4	8	49	7
SAF (BLUFOR/OPFOR) Action	6	2	51	9
Unit Support Workstation Actions	2	9	45	12
ARTEP Information	1	10	46	11
AAR Observations	2	9	46	11
Time/Comments	3	4	49	12
Overall structure of the guide	2	6	51	9

Appendix C

Demonstrations of Performance Development

The team considered both exercise-based demonstrations (with exercise-specific information) and task-based demonstrations (with expansion to many exercises, but with less individual exercise applicability). Ultimately, exercise-based demonstrations were developed when the team determined that creating the multimedia library of tasks would exceed the resources available to the project. Additionally, since many of the exercises created by the team involved performing just part of a task, tailoring the multimedia presentation to fit a particular tactical situation would be too burdensome to the O/C to be of practical use. For the relevancy to the training unit and ease of use by the O/C, exercise-based demonstrations provide a clear preview of the specific tasks occurring in their approximate location. Further, by mirroring the structure of the separate training exercises, subdivided by events, the demonstrations provide a cohesive preview of the training experience. The design structure of the demonstrations of performance included an:

- introduction to the table, with introductory narration and visual cues;
- overview of the table through a narrated, symbol-based animation; and
- discussion of each event individually (with video and audio playback of a simulated unit executing the tasks and appropriate narrative description).

The steps in development of a demonstration are shown in Table C-1. The script is the most crucial piece of the development process. A script contributes to the greatest time savings in production by driving all subsequent team functions. It is a detailed plan of what the user will see and hear. The basis of each script is the table event guide which identifies the tasks, specific terrain, and tactical situation.

The finished products combined a number of innovative techniques to provide the viewer a complete understanding of the tables. To better illustrate the actions and activities of the demonstration unit, developers used animation to show the context of the unit on the battlefield. The animation consisted of using icons to represent units (platoons, company teams, OPFOR, aircraft) over a map display printed from the CCTT system. Each table included real-time video, showing the demonstration unit performing tasks within the table in simulation. The scenes were created by putting SAF, real vehicles, or manned modules, into a "war game" scenario and recording the outcomes. After successfully performing the tasks, the camera angles were selected and the results transferred to VHS tapes. These scenes were edited in a multimedia software program and merged with the audio clips of applicable radio traffic (and voice-over narration as appropriate). The audio files (including sound effects) provided additional contextual clarification to the unit activity and task performance in addition to providing a realistic feel to the scenes.

The team created two sets of demonstrations: one for the tank platoon tables and one for the mechanized infantry platoon tables. They also investigated the utility and feasibility of demonstrations of performance for company team and higher-level echelons, and for night tables.

Because of the time needed to make individual tables and the difficulty in viewing night-time tables, night demonstrations were not developed. Company team and higher echelon demonstrations of performance were not developed due to the poor resolution of representing larger units on the simulation battlefield. The demonstrations use a stealth view from an offset camera that observes the entire unit, like an observer watching from a close vantage point. If the unit is maintaining proper dispersion, the video representations of the four vehicles in a platoon can be easily distinguished. However, when attempting the same procedure with a company team or larger unit, the dispersion is such that most of the company team vehicles are too far from the observer camera to be seen. That restricts the utility of the stealth view in a demonstration. Animation and narration would play a greater role in demonstrations for the company team echelon with the stealth view used for specific unit actions or general battlefield reconnaissance. Thus, ultimately, only platoon day table demonstrations of performance were created.

As developed, each complete performance demonstration took about 15 minutes to view, the separate events were less than three minutes in length. This design structure provided both minimal file sizes and efficient processing for available equipment. These considerations ensured the demonstration was concise, focused, and easy to use. The demonstrations were developed as multimedia, personal computer-based, self-executable files. The hardware and software requirements for viewing and for developing the demonstrations of performance, as developed, are found at the end of this section. Upon selecting a table demonstration, the viewer can replay, pause, or skip any desired event by clicking the appropriate buttons.

The plan for implementing the demonstrations called for their use with unit preparatory materials, during table previews, and as part of the AAR process. However, the CCTT AAR workstations were not able to play them because the personal computer, originally planned as part of the AAR workstation configuration, was eliminated from the CCTT design after development of the demonstrations began. The demonstrations can be used only as a stand-alone training tool, not as part of the exercise preview or AAR process. Should it be needed later, the interactive structure is designed to accommodate the expansion of an AAR segment.

Design and construction of the demonstrations required the combined efforts of a graphics multimedia artist, a CCTT recording engineer, a script writer and director, and numerous SMEs to provide technical expertise. Several issues regarding the design, development, and production time need additional comment. First, there was a substantial amount of time invested in the design of the demonstrations. Much of the first three months involved reading available resource materials, planning, experimentation with equipment and systems, research and purchase of computer hardware and software, and prototype experimentation. After the prototype received approval, development of the first three demonstrations over the next two months resulted in many enhancements to the initial design. Some of these enhancements are the addition of sound effects, closer camera angles, and the significant reduction of scene times through the use of short video clips linked together with transitions. Finally, the team settled into full production after the fifth month, enabled primarily by the establishment of the scripting template. This allowed the team to develop work flows to process several demonstrations, in different production stages, at the same time. Production also improved through the identification of the necessary CCTT workarounds, or their elimination through new software drops, needed to create the scenes.

Table C-1

Performance Demonstration Development Steps

Step	Action
1	Develop script using the event guide: • describe visuals (video, screen text, animation) • audio script (narration, radio dialogue, effects)
2	Approve script
3	Capture CCTT video: • print PVD maps • create and run table in CCTT • capture desired motion images on VHS from CCTT magnetic tape
4	Create digital video: • convert VHS to digitized video clips • record digital voice files for radio traffic, narration, and sound effects • combine and edit the video clips and audio files
5	Record remaining audio files (animation narration and task list)
6	Build animation files (create graphics and combine audio)
7	Review and approve digital video and animation files
8	Construct interactive program (using multimedia software) • build structure • verify program interactivity • create graphics • import digitized video, animation, and audio files
9	Test run program on appropriate operating systems and hardware
10	Produce and package CD-ROM

It was at this point that an unanticipated backlog became evident. As the other processes became more efficient, it was not possible for the graphic artist to keep pace. As much as possible, team members picked up some of the graphic art work. However, the availability of only one primary graphics system with the appropriate software limited that support. The addition of another graphic artist position and workstation area would substantially reduce the processing time. The costs would not double since some of the hardware would not be duplicated (e.g., additional memory requirements, scanner, CD record drive). Combining that with careful planning as to individual functions of the graphic artist positions (overall interactive design efforts versus map reproduction) could reduce software expenses further. This would only be appropriate, though, should mass production of similar demonstrations be important. If a few demonstrations are required, or the structure of each is drastically different, then it is unlikely the graphic artist position and equipment would drag production.

A significant resource investment in computer hardware and software was required to create the demonstrations of performance developed by the STRUCCTT Team during this project. The following descriptions of the hardware and software that was used is provided as a reference for training developers considering the creation of similar demonstrations.

A listing of the computer hardware used is at Table C-2.

Table C-2: Hardware
Pentium 200 computer with 32 MB RAM with: 9 GB Hard Drive 4 MB Video Card 16-bit Sound Card Video Capture Card CD-Recordable Drive
External Speakers
Microphone
Flat Bed Scanner
Television and VCR
Scan Converter
AN/PRC-77 Radio with AN/GRA-39 Remote Set Test Computer - 486/66 computer with 8 MB RAM

The scan converter was used at the CCTT site to connect the AAR workstation computer with a video cassette recorder (VCR) so that the desired CCTT video scenes could be brought back to the STRUCCTT Team's production facilities for further processing.. The VCR tapes were then played back through a video capture card installed in a computer to convert the VHC video which was in an analog format into a digital format that could be processed by the team's computer software. The radio was used to record radio traffic used in the demonstrations. As a demonstration of performance was completed, it was tested in another computer configured to meet the baseline computer specification that the contracting officer's representative directed the STRUCCTT Team to meet for viewing the demonstrations of performance.

The STRUCCTT Team used a variety of commercially available software to create the demonstrations of performance. A listing of the software is provided in Table C-3.

Table C-3: Software
Microsoft® Windows 95 or Windows NT™
Sonic Foundry® Sound Forge XP®
Adobe Photoshop™ 3.0
Macromedia FreeHand™ 7.0
Adobe Premiere™ 4.2
Macromedia Authorware® 3.5
Macromedia Director® 5.0

Authorware® was used as the multimedia authoring tool. The demonstration structure of screens, interactions, and navigation was built, integrating the separate elements (animation, video, narration, screen text) for each table. Authorware® brought the separate elements together within a working structure consisting of interactive buttons and both automated and user-determined functions. An executable file was then created that could be easily distributed and played on a variety of computer systems without the authoring software. Director® created animation for each of the demonstrations. Maps and overlays were scanned and imported; and unit icons were animated to demonstrate the appropriate actions and locations for each exercise. Premiere™ imported digital video (in conjunction with the video capture card), edit digital video and audio files, and export digital movie files in AVI format. Sound Forge® was used to record and edit digital audio files (in WAVE format). Photoshop™ handled the scanning, drawing, and editing of all images used throughout the demonstrations (e.g., maps for animation, screen backgrounds, buttons). Overlays and unit icons used in animation were drawn in FreeHand™.